AUGUST
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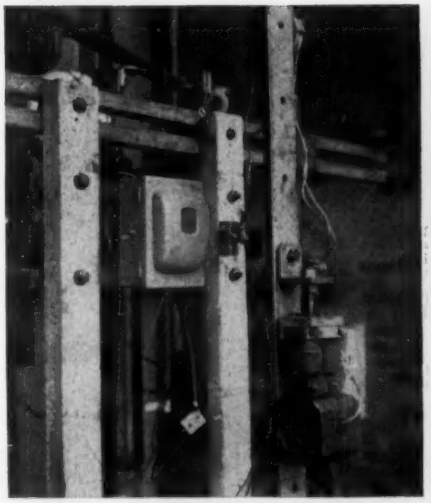
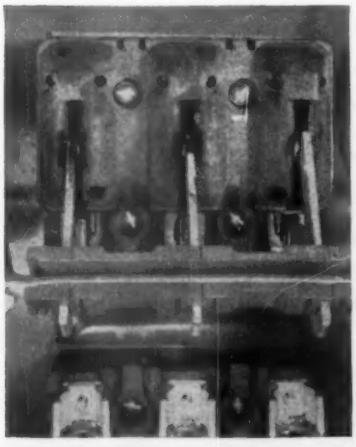


Square D switch on "torture rack" during test involving up to 100,000 ampere short circuit



SUMMARY TABLE • Extract from Report No. S/NA R66—Sheet No. 5

Ampere Rating	Voltage Rating	Catalog Number	Average Symmetrical Prospective Current R.M.S.	Recovery Voltage R.M.S.	Maximum Total Arcing Time	Fuse Type
30	250	A85351	96,500	252	.0009	A2Y-30A
30	250	A85351	96,400	253	.0010	FRN-30A
30	600	A85341	107,000	590	.0020	A6Y-30A
30	600	A85341	106,000	601	.0027	FRS-30A
60	250	A86352	96,400	248	.0010	A2Y-60A
60	250	A86352	95,200	252	.0019	FRN-60A
60	600	A86342	106,000	605	.0011	A6Y-60A
60	600	A86342	108,000	598	.0020	FRS-60A
60	600	A86342	107,000	601	.0013	NAS-60A
100	250	A86353	95,200	253	.0009	A2Y-100A
100	600	A86343	108,000	604	.0014	A6Y-100A
200	250	A86354	95,200	253	.0037	A2Y-200A
200	600	A86344	107,000	602	.0011	A6Y-200A
400	250	A86355	95,900	252	.0039	A2Y-400A
400	600	A86345	106,000	611	.0050	A6Y-400A
600	250	A86356	94,500	251	.0062	A2Y-600A
600	600	A86346	107,000	601	.0062	A6Y-600A

Above • Extract of Nelson High Power Laboratory Report C/NA-66

At left • No sign of failure in this switch interior after 100,000 ampere short circuit test

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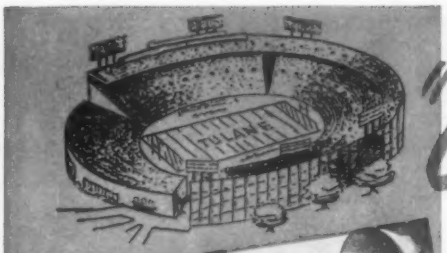

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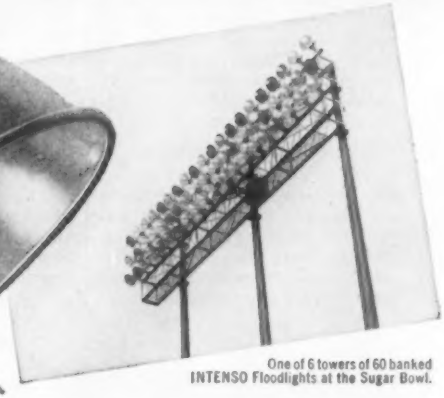
Workman at Sugar Bowl checking INTENSO light before bank is raised to tower height.

Photos courtesy of Tulane University

Mario Zervigon and Associates., Consulting Engineers

Opens for Split-Second Rear Relamping



One of 6 towers of 60 banked INTENSO Floodlights at the Sugar Bowl.

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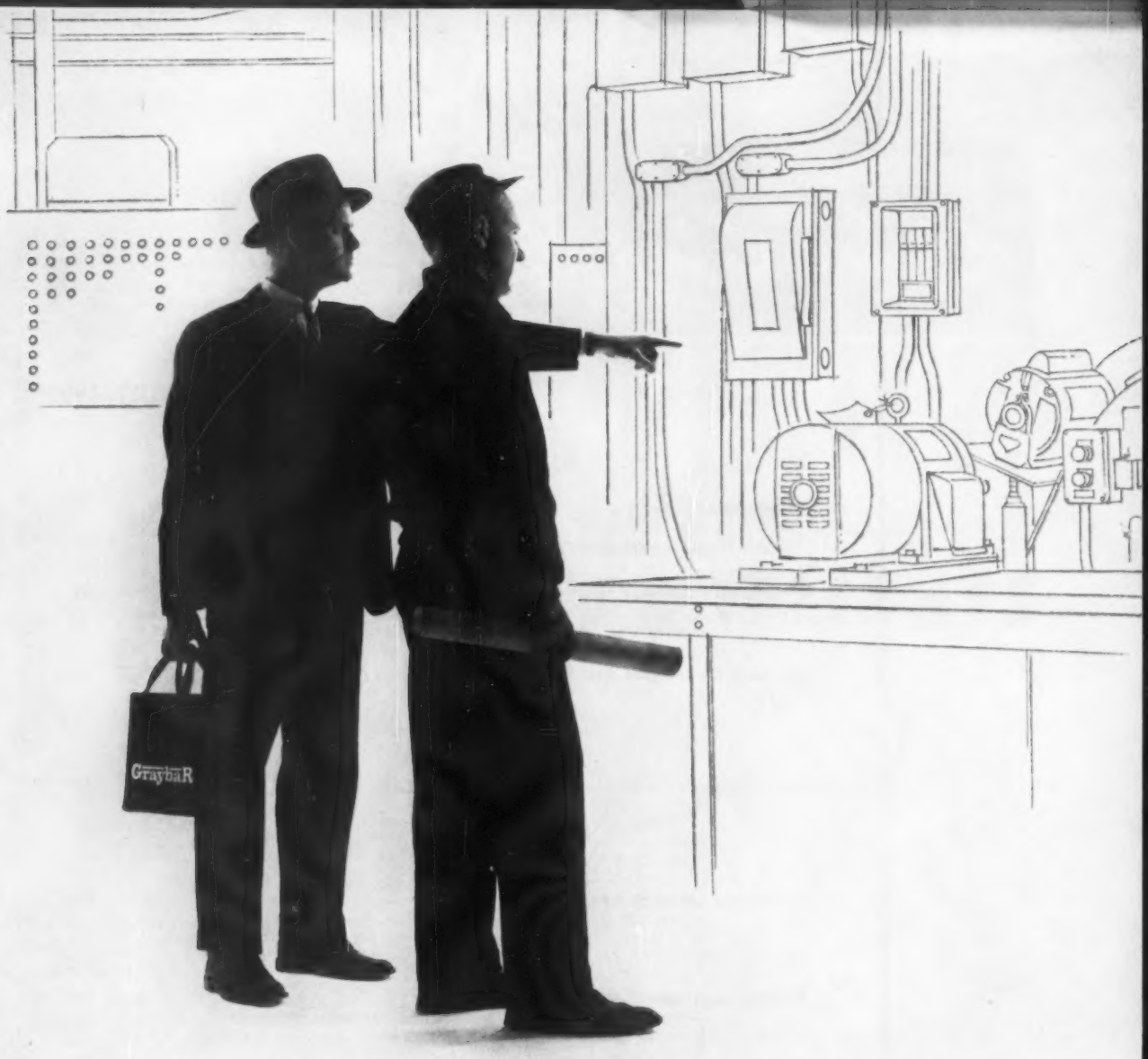

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

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Coordinated lift raises 64-ft-long pre-assembled lighting run into mounting position as single unit.

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Sidelights

ALL ELECTRIC HOME

The new home built by Norman Ferguson, president of California Electric Works in San Diego, is a showcase of modern electric living. The work includes many novel features representing advanced practice in residential wiring, lighting, heating, communication and controls. Hugh Scott's photo story of the installation, "Gold Medallion Home," appears on page 90.

NEW FACTORS

Aluminum rigid conduit for wiring raceways has been attracting wide attention in the industry since the price dropped early this year to a level directly competitive with steel. Use of aluminum conduit introduces new factors in design and installation of particular interest to engineers and estimators. The non-magnetic raceway provides somewhat different line impedance characteristics, particularly in large feeders, and the light weight metal offers potential labor savings. Application of these new factors to a typical electrical system installation is explored by Elden G. Fox, Senior Electrical Engineer, Kaiser Aluminum and Chemical Corp., in his article "Non-Magnetic Metal Raceways Cut Feeder Costs," beginning on page 78.

LIGHT FOR PARKING AREAS

Adequate and attractive parking area lighting is an important feature of shopping center operation. One such installation is the 44-acre parking area at Mayfair in Milwaukee. The installation uses nearly 800 color-improved 400-watt mercury vapor lamps in open aluminum floodlights. John S. Haney, Crouse-Hinds Co., describes the details of the installation in "Mercury Floodlights Aid Parking" beginning on page 75.

JOB CONTROL

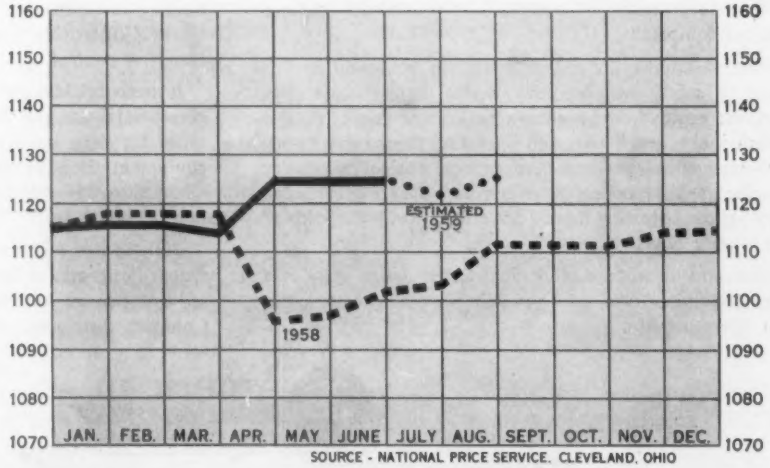
Adequate records are essential to efficient business housekeeping. A simple but comprehensive system developed by Esther P. Hedrick, co-owner of Hedrick Electric Co. in Columbus, Ohio, keeps an accurate record of each job's status from the initial inquiry through to final payment and filing. Her article "Adequate Job Records" begins on page 92.

ELECTRIC HEATING COSTS

A penetrating analysis of the factors affecting the accuracy of electric heating costs estimates begins on page 71. Glydewell Burdick of Wisconsin Power and Light Co. reviews the fundamentals involved and presents original thoughts on calculating procedures to supply information unavailable from statistics or experience data.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



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Now, for the first time, the new American Electric Type "ND" Safety Switch offers *all* of the features "most wanted" in *one* safety switch by people who work with and use electrical equipment.

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Bulletin 250-ND fully describes every detail of this new switch designed for "matchless safety". For your free copy see your nearest American Electric Switch—Clark Controller Company distributor. Or, write direct. 9881

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Washington Report

AUGUST • 1959

The current boom level of business activity should continue well into 1961, in the opinion of President Eisenhower's economic advisers. The economy has fully recovered from the 1958 recession, as one economic indicator after another breaks through old records to new highs. These include: 1) Gross national product in 2nd quarter hit a $483.5-billion annual pace, topping the pre-recession-high annual rate of the 3rd quarter of 1957; 2) industrial production in June hit an FRB Index of 155 (1947-49—100), 6 points above the pre-recession-high of 146 in February 1957; 3) personal income in June rose to a seasonally-adjusted annual rate of $382.9 billion; and 4) employment at mid-June hit a new record of 67,342,000 with an average factory work-week of 40.6 hours.

The rate of business rise is beginning to decrease slowly, and is not unexpected. The rapid climb from 1958 recession lows was spurred from two sources: recovery from the recession, and normal growth. The expected slowdown will be a good thing, Washington officials believe, as it will remove some of the upward pressure on prices, moderate the forces which make for inflation.

Cost-of-living inched up in June to a new high, as Consumers Price Index rose 0.5% to 124.5% of the 1947-49 average, biggest monthly advance in 18 months. A sharp rise in food prices was responsible for about four-fifths of the rise, BLS reported.

Individuals added $5.5 billion to their savings during 1st quarter this year, SEC reported, same as during similar period of last year. But consumers are raising their spending plans, according to report of University of Michigan's Survey Research Center based on its May-June survey. The sharpest spurt in buying plans are for houses and used cars, the report stated, which also indicated no spending "splurge" was in sight.

Construction activity continues its steady upward climb, month after month, and accounts for between 11% and 12% of gross national product.

June construction hit $5 billion, a record for the month, Labor and Commerce Depts. reported. Private construction totaled $3.5 billion.

Construction spending for the first six months of this year hit a record $24.9 billion, for a seasonally adjusted annual rate of $55.1 billion. Private outlays hit a record $17.5 billion, while public spending totaled $7.4 billion. Most of the gain in private spending came in residential buildings: $10.2 billion this year compared with $7.7 billion last year. Much of the six-month gain in public spending came from higher outlays for highways, housing, and military construction.

Housing starts in June totaled 136,000, up from 134,000 in May. For the first-half-year period, starts totaled 709,500 units, a record for the period. Starts on private units were 690,700 units, compared with 498,000 starts during first half of 1958, and compared with 696,500 units in 1950, the record to date.

Electric power output is running ahead of year-ago records by from 10 % to 18% in weekly reports of Edison Electric Institute. Output in last week in June set a new weekly record of 13,749-million kwh. All areas of the country recorded gains.

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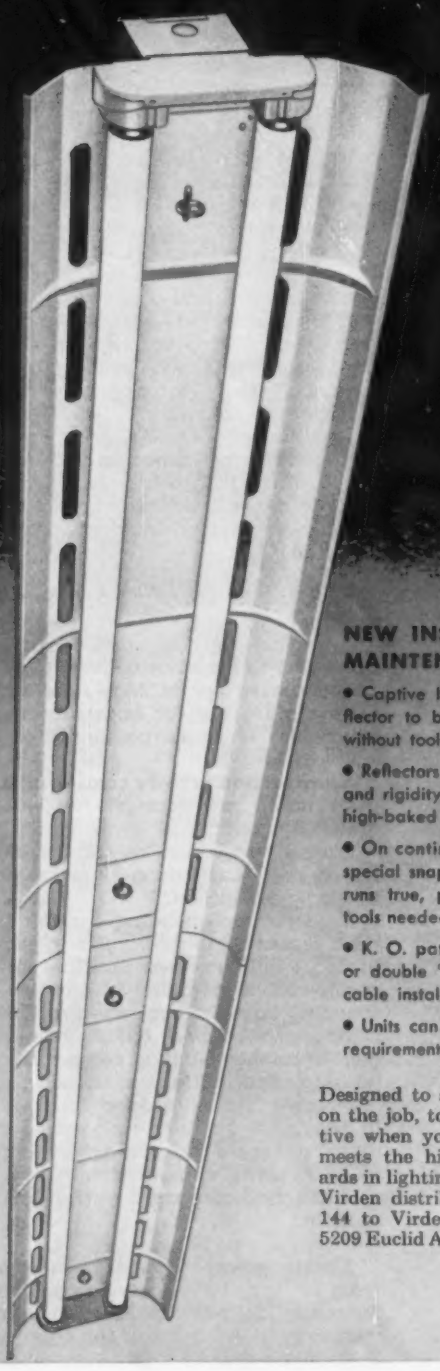

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Goes Into High Gear

In 1959, industry will spend more money than ever before to modernize its plant and equipment. But it is not spending enough to do the job that needs to be done.

Manufacturing companies* now plan to spend a total of $24.5 billion on modernization in the four years 1959-1962. This will be enough to replace roughly 70% of the obsolete facilities that were on hand at the beginning of 1959. But it will still leave us far short of our goal. It would take several years, at a higher rate of investment than is now planned, to wipe out obsolescence and give the U. S. a truly modern industrial plant.

These facts stand out from the 12th annual Survey of Business' Plans for New Plants and Equipment just completed by the McGraw-Hill Department of Economics. This new survey shows that industry has made a remarkable start on the modernization job that a previous editorial in this series described as "the most expensive task to be performed in America in this new year of 1959." The full cost of modernization has been found by the McGraw-Hill Department of Economics to be $33.3 billion for manufacturing, and $95 billion for all business.

For the past several months, McGraw-Hill publications have been devoting special attention to new developments in plant and equipment that offer opportunities for modernization. Our special effort to help industry in this regard has been called "Plan '59": to modernize *now* for growth and profits. This editorial will summarize the progress made so far with "Plan '59" and point out some of the areas where business and public policies can do still more to accelerate the modernization drive.

A Good Start

Business investment in new plant and equipment has picked up sharply since the low point of the 1958 recession. Plans for 1959 now show a 7% increase over 1958 for total capital investment. And the increase in expenditures for modernization is much sharper. Moreover, companies already have substantial plans for the years after 1959. New orders for industrial machinery, which are a good index of modernization plans, also are running well ahead of last year.

For the four-year period 1959-1962, manufacturing companies expect, on the average, to devote 65% of their plant and equipment outlays to modernization. This is the highest proportion reported in a McGraw-Hill survey since 1950. In dollar terms, manufacturing companies plan to spend $24.5 billion on modernization during the next four years.

This is an impressive figure, but it does not look so large when compared with the total need

*Excluding petroleum refining, which is reported as part of the oil industry in the data discussed in this editorial.

for modernization in manufacturing industries. As noted above, a previous McGraw-Hill study (conducted in August 1958) found that it would cost almost $35 billion to replace all the facilities that manufacturing companies then considered obsolete. Thus, present plans for modernization are enough to wipe out only 70% of the backlog of obsolete facilities by 1962—and this makes no allowance for the additional facilities that will be made obsolete by new machines and new processes introduced during the next four years. When these new developments are considered, present plans for spending may represent only half the job that will actually need to be done.

How To Accelerate

What can be done to accelerate the drive to modernize our industrial plant and equipment? Two of the greatest aids would be:

(1) Improve present provisions under the tax law for depreciation, to help industry retain more of the money it needs to carry out this massive job of modernization;

(2) Contain inflation, to preserve the purchasing power of the money industry sets aside to replace obsolete facilities.

At first glance, the supply of funds from depreciation allowances appears to be more than adequate. For manufacturing as a whole, depreciation allowances—the primary source of cash for modernization—will total $8.3 billion in 1959, compared with present modernization plans of $6.4 billion. Thus some extra funds will be available to support a further step-up in modernization in 1960.

Unfortunately, however, these depreciation funds are not evenly distributed from industry to industry, or from company to company. For example, in several of the metalworking industries, the prospective flow of cash from depreciation during the next four years is much less adequate than for manufacturing as a whole. These are industries with relatively large modernization backlogs, and they also are industries made up mostly of small or medium-size companies that have difficulty tapping the public money market.

As a result of these industry and company differences, there are many individual cases where shortages of funds limit the amounts of modernization now planned. In the McGraw-Hill survey, nearly half of all companies participating said that they would spend more on new plants and equipment if the depreciation allowances permitted by the tax law were increased substantially over the next few years. Most of these were relatively small companies. Their answers suggest that revision of the tax rules on depreciation should receive the most careful consideration as a spur to faster modernization.

The problem is complicated also by the threat of further increases in the national price level, which would necessarily include prices of capital goods. If "creeping inflation" resumes its march during the next four years, depreciation allowances based on present costs will be much less adequate for future needs. This points up the importance of national economic policies to maintain price stability. Unless this can be maintained, industry's dollars will not go far enough to do the modernization job that is needed.

Plan '59 Carries On

Industry's drive to modernize is now well underway. It can make a key contribution to our national strength and prosperity in 1959 and the years ahead. But the biggest part of this job is before us. It is up to the policy makers—in both business and government—to see that the job is done.

This message was prepared by the McGraw-Hill Department of Economics as part of our company-wide effort to report on opportunities for modernization in industry. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or part of the text.

Donald C. McGraw

PRESIDENT

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from General Electric

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for every street and highway

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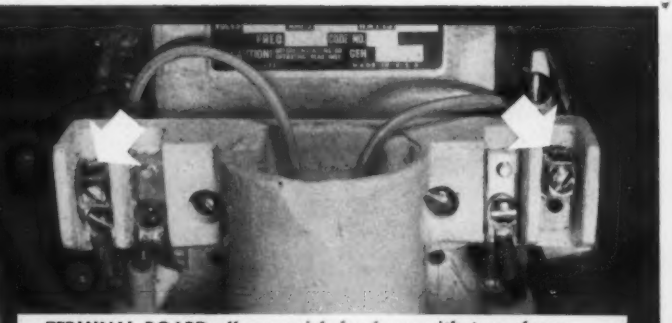
175 and 250 watt
residential and light-traffic streets

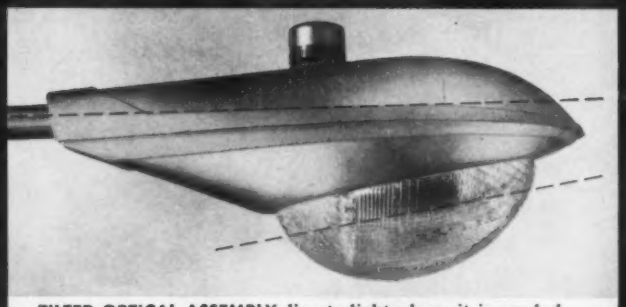
Get top efficiency, new modern

POWER PACK built-in ballast saves $50-75 per unit during installation—175- to 1000-watt sizes.



TERMINAL BOARD allows quick hook-up with two clamp-type screws; eliminates splicing, other interconnections.

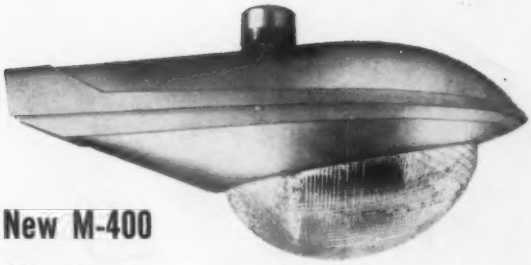
UNIVERSAL SLIPFITTER easily adjusts for 1¼- or 2-inch brackets. Requires no additional parts.



TILTED OPTICAL ASSEMBLY directs light where it is needed, contributes to graceful styling.

SEALED OPTICAL ASSEMBLY—silicone rubber gaskets block entry of bugs and dust, reduce cleaning.

UNIT PHOTOELECTRIC CONTROL with dependable new G-E cadmium sulphide cell locks on top of unit.



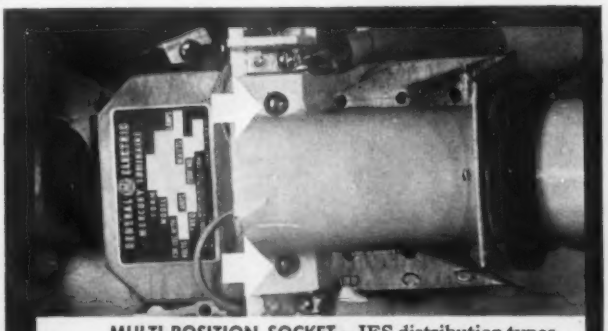
New M-400

400 watt
business and traffic streets, highways

New M-1000

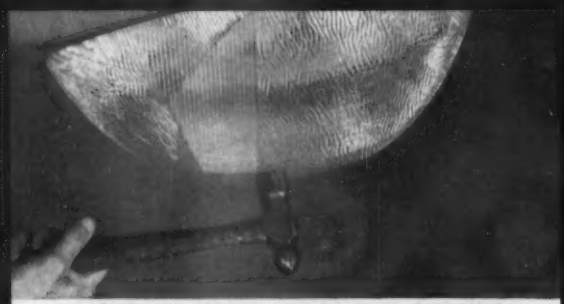
700 and 1000 watt
whiteways and shopping centers

styling, plus these extra values



MULTI-POSITION SOCKET—IES distribution types are easily selected by simple screw adjustment.

LAMP FLEXIBILITY—complete lamp selection—clear, white, color improved, 175 to 1000 watts.



ACRYLIC REFRACTOR on M-250 unit, heat-resistant glass refractors on other units, cut breakage.

Smart styling . . . unequalled efficiency . . . economical operation . . . all are yours with new General Electric mercury luminaires. And, for the first time you'll find ratings for every street and highway *in a single design family.* 100% designed by General Electric — with components engineered to work together—this new mercury line delivers these major user benefits:

Unparalleled photometric performance – Precisely contoured reflector and proven prism design give optimum light output and control.

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☐ New Mercury Luminaires, GEA-6943

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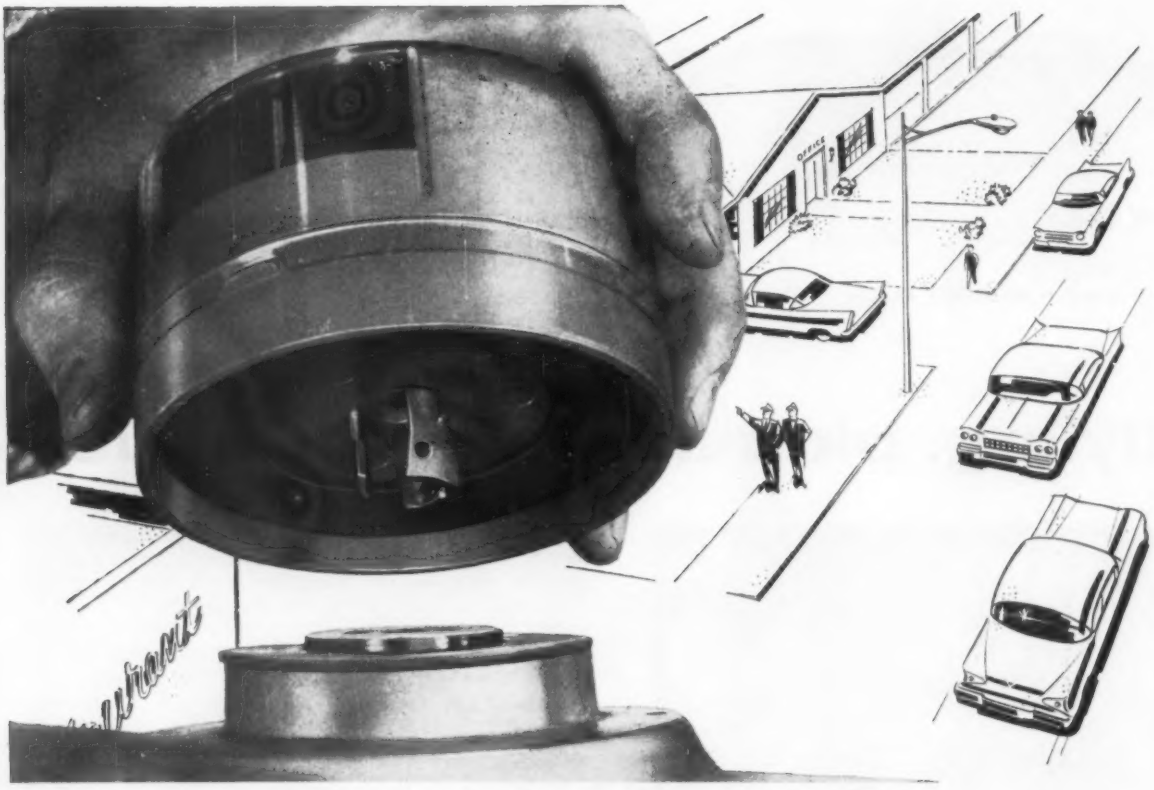

Reliable—after years of tests

New G-E cadmium-sulphide control installs in seconds . . . lasts for years

Now, from General Electric comes the industry's newest, most dependable cadmium-sulphide photoelectric control. Years have been spent in the research, design, and testing of this new street lighting control to produce the most efficient, most reliable cadmium-sulphide control available. Now, after exhaustive testing, the reliability problem has been solved with a custom-built General Electric cadmium-sulphide cell. Shock, surge, humidity, vibration, load, temperature—these were among the tests conducted —but none was found to alter the dependable performance of the new G-E control.

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Get the full details from your General Electric Apparatus Sales Engineer or Agent, or write Section 450-25, General Electric Company, Schenectady, New York.

Progress Is Our Most Important Product

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are clean, easy stripping, with solid, gleaming colors, and minimum diameter for easier installation in boxes.

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which is tough, moisture-resistant yet easily removed, gives protection to the insulated conductors.

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is used in all sizes. A flattened aluminum bonding wire in contact with the under side of each convolution of the galvanized steel armor assures a permanent, low resistance through armor to ground.

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At intervals of every 1½ inches on CRESCENT A.I.C. Armored Cable you will find a small cut mark. This cut mark shows the location of a prefabricated breaking line inside the armor.

ONLY a few short strokes of a hacksaw guided by the cut mark are required to cut through ONE outer ridge, and a bend by hand severs the armor. By actual test, this saves 30% of the time ordinarily required. A clean separation results, with no sharp edge. There is no chance of injury to insulation because only one OUTER ridge is cut.

THE prefabricated breaking lines in the armor are so made that **THERE IS NO REDUCTION** of tensile strength, bending qualities, crushing resistance or electrical conductivity. This armor construction meets all requirements of Underwriters' Laboratories.

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TRENTON, NEW JERSEY

OVER 75 YEARS EXPERIENCE

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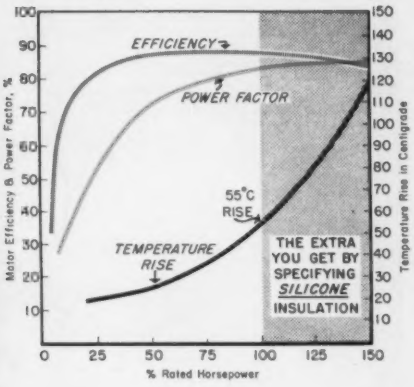

Specify High Service Factor Motors for lowest initial cost, lowest operating costs . . . maximum reliability.

Leading manufacturers now offer motors designed to an entirely new concept. These motors are available in standard NEMA frames of the same size used for conventional motors of the same rating, but look alikes don't perform alike.

These new motors, insulated with Dow Corning Silicones, have a built-in reserve to carry overloads of twenty-five to fifty percent above nameplate horsepower rating. Here's what this means to you:

Simplified Motor Specifications: Specify motors that are silicone insulated for high service factor. With nameplate horsepower ratings identical to nominal loads, these motors will handle temporary, or even continuous overloading. No need to calculate maximum possible load and add a safety factor. It's already built in.

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Less Installed Horsepower: With motors rated to match normal loads, total installed plant horsepower will be substantially less. Using conventional methods of determining distribution system needs, transformer and switchgear requirements are lower—less costly units can be safely specified.

Motors insulated with Dow Corning Silicones for high service factors are available now from leading motor builders. For more information on what silicone insulated equipment can mean to you, write Dept. 3920.

How do manufacturers build so much extra into a motor? By substituting an insulation system made from Dow Corning Silicones for the Class A insulation system used in standard lines. Only the insulation changes. Frame, electrical steel and copper remains the same. And there's one change on the nameplate.

Service factor rating goes up. On a TEFC motor, for example, service factor goes up from 1.00 with Class A insulation materials to somewhere between 1.25 and 1.50 when silicones are used, depending on manufacture and horsepower rating.

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Motors insulated with Dow Corning Silicones give reliable operation in almost any surroundings—regardless of high ambients, moisture, many corrosive atmospheres. And on the basis of capability, high service factor motors generally cost less than conventional motors.

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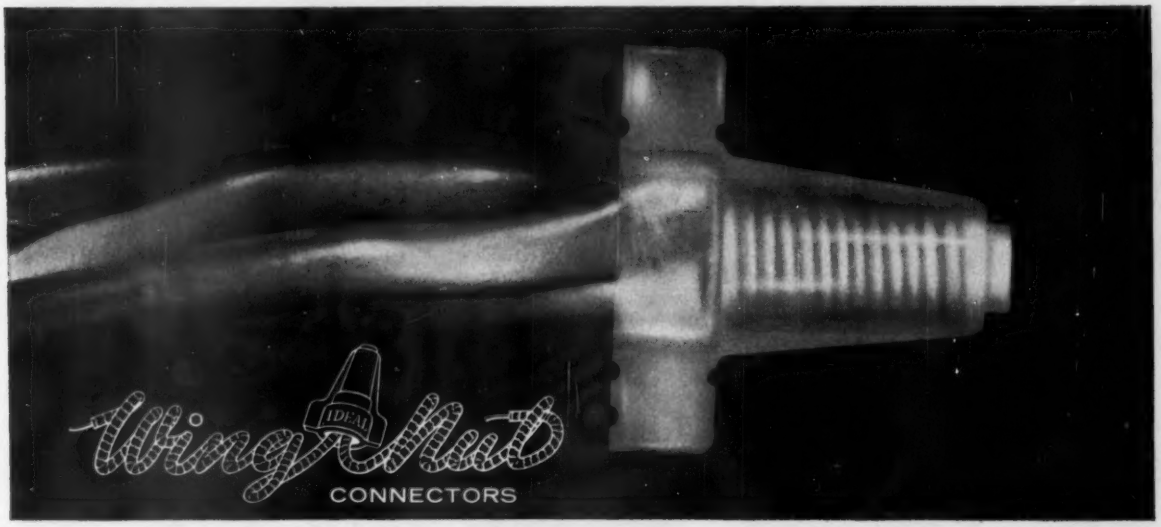
NEW WIRE CONNECTOR



At last -- a really easy way to join heavy gauge, hard wires!

BUILT-IN-WRENCH

New wings make it 50% easier to screw on, even on new stiff vinyl-insulated #6 wire. Wings eliminate wrenches; can be snipped off after applying.

"PYTHON GRIP"

New internal tension-spring coils adapt to shape and size of wires—apply tremendous pressure evenly over entire stripped area. Pressure is so great wires are threaded and crushed together.

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Insulating cap is Nylon . . . high dielectric, unbreakable and abrasion resistant. You can actually see your splice inside the semi-transparent Nylon shell. Compact—uses less space in junction box. U.L. approved for recessed fixture wiring because Nylon shell withstands 105° C.

Actual size Models 452 and 453. Both "WING-NUT" Connectors approved as pressure cable connectors, for general use (600 V) in branch circuit and fixture wiring.

New IDEAL "WING-NUT" Connector gives you the easiest yet most perfect mechanical connection possible. Wide skirt opening makes it easy to connect larger combination wires (example: two #8 with a #6) as well as the thickly insulated Type R wire.

The new "WING-NUT" Connectors handle 474 possible combinations of solid or stranded wire . . . almost twice the number of other single piece Connectors. "WING-NUT" is available in two sizes.

Ask your electrical distributor about his special introductory offer.

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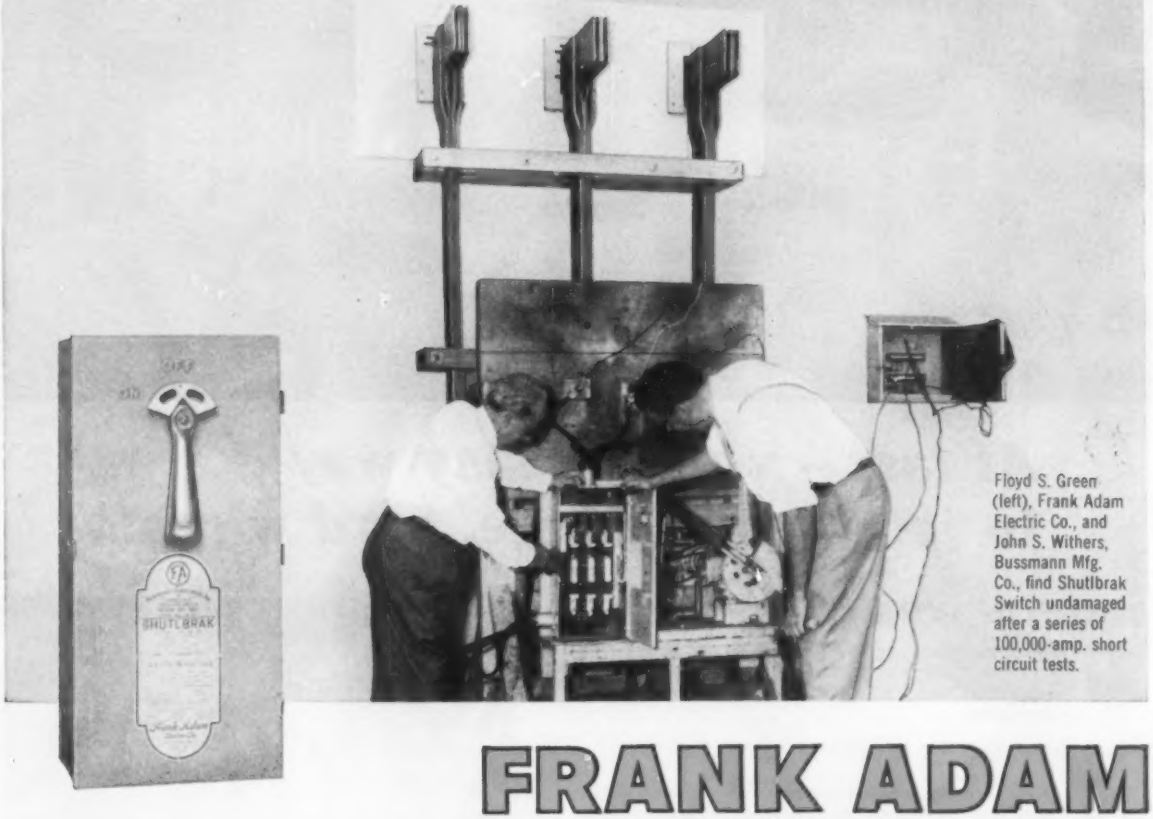

Floyd S. Green (left), Frank Adam Electric Co., and John S. Withers, Bussmann Mfg. Co., find Shutlbrak Switch undamaged after a series of 100,000-amp. short circuit tests.

FRANK ADAM SHUTLBRAK SWITCHES

(SHUTTLE BREAK)

TYPICAL TESTS MADE WITH Ⓕ 3-POLE SHUTLBRAK SWITCHES

Switch Capacity	Fuse Type
100-amp. 250-v. Same switch	KTN Limitron LPN Low Peak
200-amp. 250-v. Same switch	KTN Limitron LPN Low Peak
100-amp. 600-v. Same switch	KTS Limitron LPS Low Peak
200-amp. 600-v. Same switch	KTS Limitron LPS Low Peak
400-amp. 250-v.	LPN Low Peak
600-amp. 250-v.	LPN Low Peak

In recent tests at Bussmann Manufacturing Company's test station, Frank Adam Shutlbrak Switches, equipped with Bussmann high interrupting type fuses, went through a series of tests with switches "closed" on a 100,000-amp. short circuit. **NOT A SINGLE BREAKDOWN OCCURRED!**

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It costs no more for the extra *vital margin of safety* provided by Frank Adam Switches. Specify this better equipment. A new brochure is just off the press—*write for yours!*

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Chief Electrical Engineer
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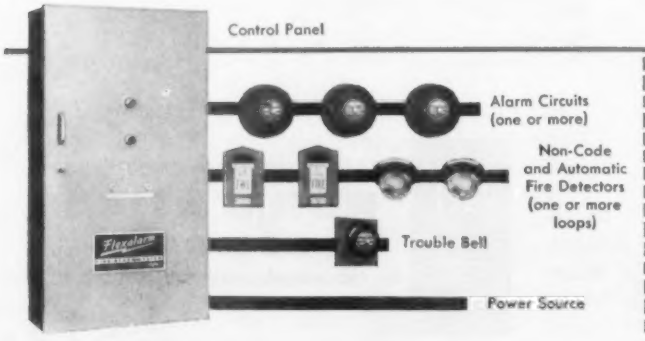

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Pan-type diffusers of PLEXIGLAS *in classrooms and cafeteria of Roosevelt Elementary School, Middletown Township, Pa. Diffusers are 1′ x 4′, 2′ x 4′, and 4′ x 4′ in size.*

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Highest efficiency in transmission and diffusion of light
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These advantages of strong, rigid PLEXIGLAS add up to *lighting of the highest quality*, for buildings that deserve the best. We will be glad to send you samples of white translucent PLEXIGLAS, and the names of manufacturers who use PLEXIGLAS in their lighting equipment.

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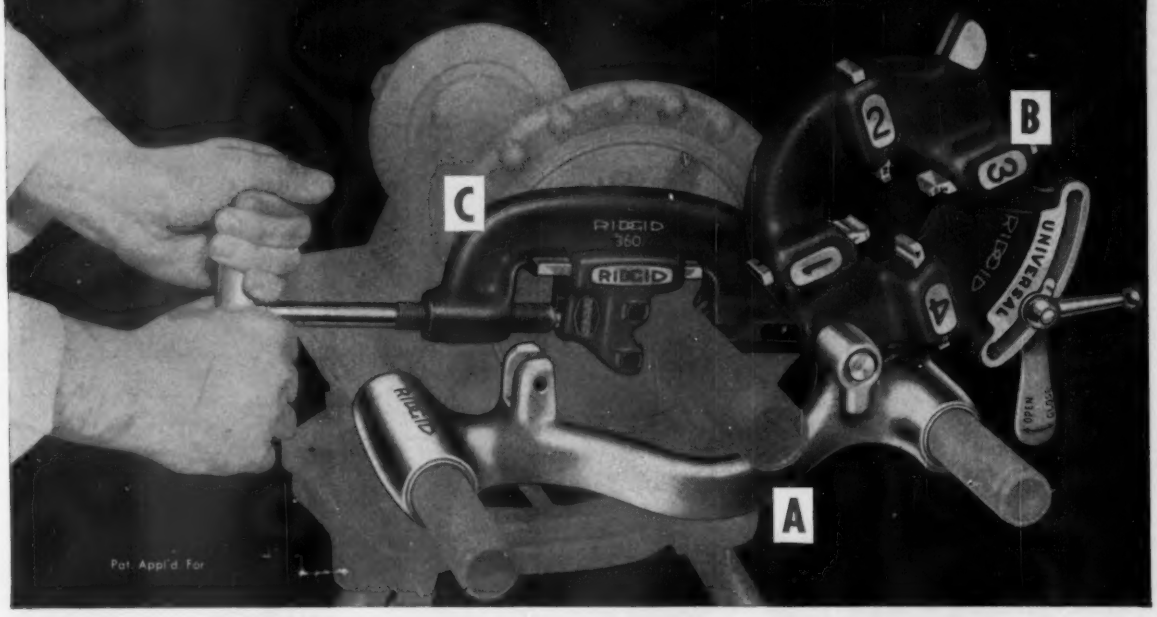

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A **RIDGID No. 310 Carriage** — Slip this strong, lightweight aluminum alloy carriage on the support arms of your RIDGID 300 Power Drive, and you'll get real cut-and-thread efficiency! Holds die head and cutter at your fingertips exactly like a threading machine. No fumbling for right size threader... no tools to drop. Easy sliding... snugs right up to chuck for close threading and cut-off.

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Die head and cutter operate independently... swing up and stay out of way when not in use. Add a RIDGID No. 19 Nipple Chuck and you can thread close nipples.

For a bargain in fast, easy work, equip your RIDGID 300 Power Drive with these accessories ... available individually... at your Supply House!

RIDGID

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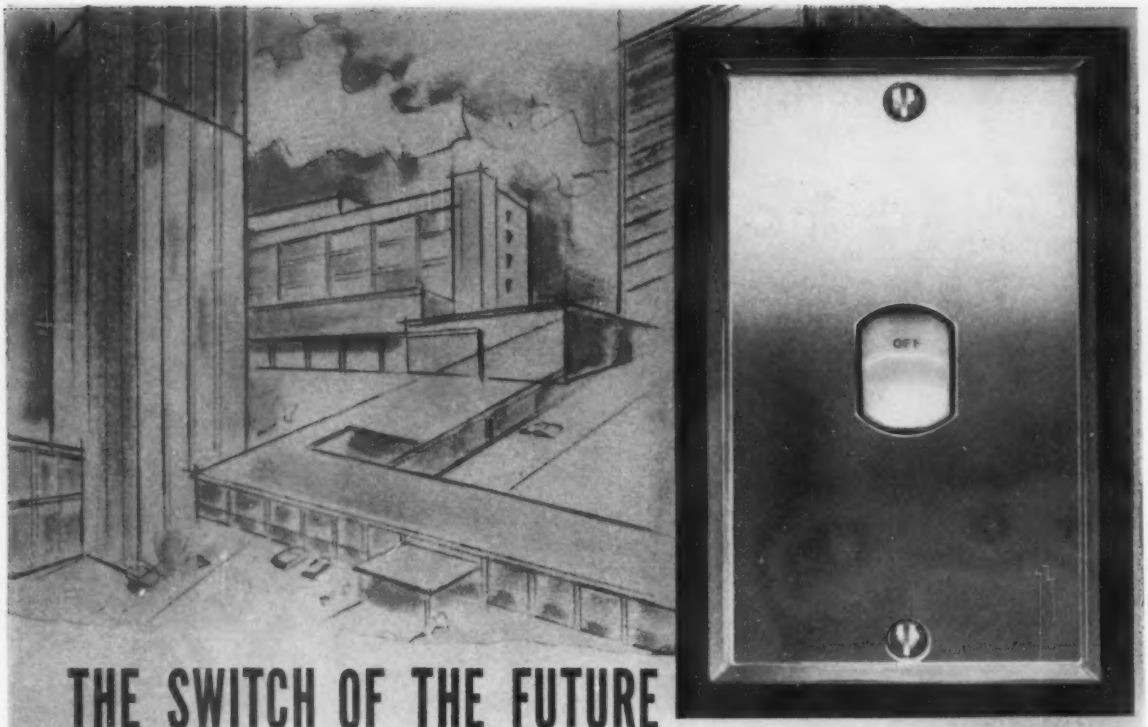


THE SWITCH OF THE FUTURE

is being used NOW! . . .

P&S ROCKER-GLO SWITCH

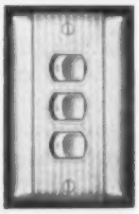
Many of today's switches are specialties primarily designed for appeal in decoration. Others are designed to meet the rugged use and performance called for by a heavy duty switch.

Now, one new switch, Rocker-Glo, combines eye-appealing design with heavy duty performance. So impressed with this combination are architects, engineers and contractors that Rocker-Glo is already being specified in leading hotels, motels, hospitals, commercial buildings and housing developments. Rocker-Glo has high-grade silver alloy contacts and positive make-and-break rocker arm construction. Its modern design and unique construction allow this switch to be pressed, pushed, rocked or rolled into instantaneous action.

Rocker-Glo switches are specification grade AC switches designed to be used at full current rating on tungsten filament and fluorescent loads (one switch takes the place of two ordinary AC-DC switches on fluorescent loads). It can be used anywhere old style toggle switches are used.

And Rocker-Glo's clean functional lines and soft beauty lend the final decorative touch.

Available in Despard interchangeable type, Despard type mounted on a strap and narrow rocker for tumbler switch plates. A specification grade switch, 15 and 20 amps. 120/277 volts AC.



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Simplex PRODUCTS GUIDE

SIMPLEX WIRE & CABLE CO., CAMBRIDGE 39, MASSACHUSETTS, U.S.A.

Simplex ANHYDREX Insulated Cables for Power transmission and Communication (like the Simplex TIREX Portable Cords and Cables shown in adjacent column), though manufactured as stock products, are custom designed to suit all service requirements. A large technical and engineering staff at Simplex' main plant is equipped to give you the benefits of their long experience in electrical cable planning.

ANHYDROPRENE — Simplex ANHYDROPRENE Cables are designed for economical installation in ducts, conduits, racks, trays and raceways. Stock sizes AWG 14 to 1000 MCM are recommended for 90 C service in WET or DRY locations. The words "Simplex ANHYDROPRENE" are either printed or molded plainly on the jackets of all ANHYDROPRENE cables. This marking signifies the traditionally high quality of a Simplex product.

CATALOGUE #1028

ANHYDREX-NEOPRENE — Simplex ANHYDREX-NEOPRENE Cables have the added mechanical protection of a heavy wall of neoprene jacketing. These cables are manufactured for use in aerial installations and for direct burial service. Stock sizes AWG 14 to 1000 MCM are recommended for 90 C service in WET or DRY locations.

CATALOGUE #1028

ANHYDREX-PLASTEX — Simplex ANHYDREX-PLASTEX (ANHYDREX-insulated, PLASTEX-jacketed) Cables are scientifically designed for compatibility between insulation and jacket, and for perfectly balanced performance in ducts, conduits, aerial and direct burial installations. ANHYDREX-PLASTEX Cables are recommended for service in a number of environments but especially where oils and chemicals are a problem.

CATALOGUE #1028

ANHYDREX Insulated Control Cables — Simplex ANHYDREX Control, Signal and Communication Cables have an additional thickness of appropriately coded neoprene over each individual conductor, plus heavy-duty neoprene jackets. ANHYDREX insulation provides excellent signal reproduction and is exceptionally stable, even when operating with high ambient temperatures.

CATALOGUE #1028

ANHYDREX XX — Simplex ANHYDREX XX is a butyl-based insulation of the highest possible quality. Because of its exceptional resistance to heat and ozone, it has general applications in circuits operating up to 35,000 volts, with permissible conductor temperatures of 90 C. to 5KV, and 85 C to 17KV — in wet or dry locations.

CATALOGUE #1023

CONDEX — Simplex CONDEX Cables are protected against mechanical damage by interlocked metallic armor. The armor is manufactured of galvanized steel, plain or baked enameled (colored) aluminum, bronze or other metals, and can be applied over any cable core within a very wide diameter range. CONDEX Cables may be further protected by a thermoplastic covering over or under the metallic armor.

CATALOGUE #1024

TIREX SO and SJO Cords — TIREX SO and SJO Cords are constructed to meet the most rigid specifications. All of their special features are carefully selected and processed to give maximum qualifications for portable service. They will twist without kinking, and bend without breaking. TIREX stranding affords maximum flexibility without sacrificing strength.

Conductor temperature rating 75c

CATALOGUE #992

TIREX Low Voltage Portable Cables — TIREX Low Voltage Cables are individually designed for specific applications. They are practically indestructible when used to do the work for which they are intended.

Conductor temperature rating 75c

CATALOGUES #992 & #1011

TIREX High Voltage Portable Cables — TIREX High Voltage Portable Cables have unequaled strength and versatility. Designed primarily to transmit energy to mobile electrical equipment, they are also used as temporary power lines during alterations or emergency repairs.

Conductor temperature rating 75c

CATALOGUE #1012

TIREX Mine Locomotive Cables — TIREX Mine Locomotive Cables — both single and two-conductor concentric — are approved by the Bureau of Mines and have the raised marking "P-101 BM" on their heavy-duty neoprene jackets. All TIREX Cables are cured and conditioned for service in lead.

Conductor temperature rating 75c

CATALOGUE #1011

TIREX Mining Machine and Shuttle Car Cables — TIREX Mining Machine and Shuttle Car Cables are designed for stability under today's rigorous mining conditions. The insulated conductors are "ribbed" or gear-shaped. This feature causes them to interlock with the heavy duty neoprene jacket and prevents them from slipping. Both Type W and Type G have "P-101 BM" molded onto the jacket.

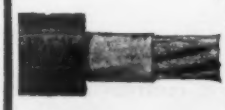
Conductor temperature rating 75c

CATALOGUE #1011

TIREX Dredge and Shovel Cables — TIREX Dredge and Shovel Cables are masterpieces of engineering achievement. Every consideration has been given to safety and durability. Simplex special cured-in-lead neoprene armor effectively resists all the elements normally encountered in this type of work.

Conductor temperature rating 75c

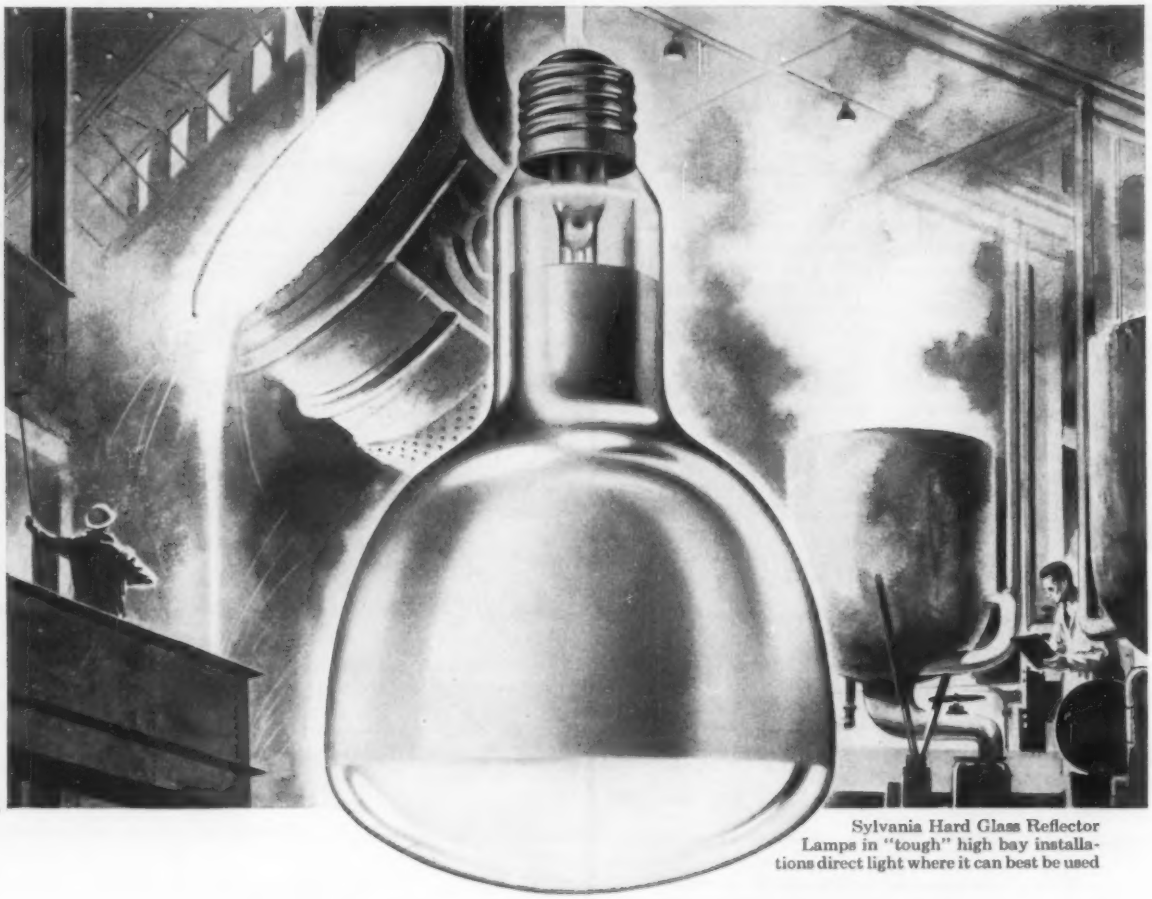
CATALOGUE #1012



TIREX Welding Cables —TIREX Welding Cables are scientifically stranded for maximum flexibility without wrist drag. Cured-in-lead neoprene jackets provide utmost safety for both operator and bystanders.

Conductor temperature rating 75c

CATALOGUE #1011



Sylvania Hard Glass Reflector Lamps in "tough" high bay installations direct light where it can best be used

For your toughest lighting jobs . . .

New Sylvania Hard Glass Reflector Lamps resist thermal shock!

Here are incandescent bulbs specially developed for high bay industrial lighting in foundries, steel mills and other "tough" installations. They are the new Sylvania heat-resistant Hard Glass Reflector Lamps.

These new tough-job lamps increase protection against breakage due to thermal shock and high moisture conditions.

With a rated life of 2000 hours, Sylvania Reflector Lamps offer more than twice the service of ordinary incandescent bulbs of the same wattage. Their longer life cuts in half the labor costs for lamp replacement.

Sylvania Hard Glass Reflector Lamps are available in 500, 700 and 1000-watt sizes. These are in addition to the Standard (Soft Glass) Reflector Lamps in 500 and 750 watts for 120, 125, 230 and 250 volts.

For further information and free literature, call your Sylvania supplier or write:

SYLVANIA LIGHTING PRODUCTS
Dept. 9L-8308, 60 Boston Street, Salem, Mass.
In Canada: Sylvania Electric (Canada) Ltd.
P. O. Box 1190, Station "O", Montreal 9

SYLVANIA
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

ALLIS-CHALMERS

"Profit Line for '59"
Electrical Products from **ALLIS-CHALMERS**

ONE MAN can provide ALL this equipment

He's your Allis-Chalmers representative. *One inquiry* to him and much of the equipment you need for any electrical construction job is available.

Time and Money Savings for Extra Profits — because a single, dependable source means "unit responsibility" for deliveries, installation help, fast parts service. And, once installed, this equipment continues to be backed by outstanding field service — without "buck passing."

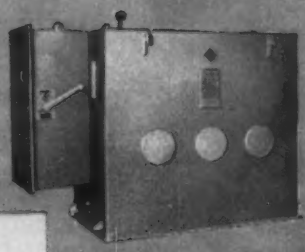
Ask "The Man" about the profitable A-C products for electrical construction. *Or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.*

A-C ALLIS-CHALMERS A-1028-EC

Super-Seal Motors

Motor Control

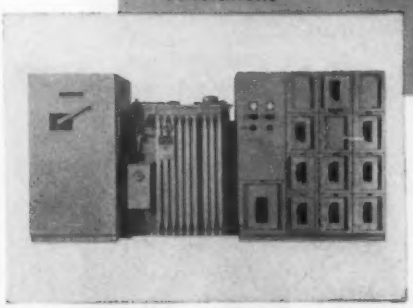
Texrope Drives



Dry-Type Transformers

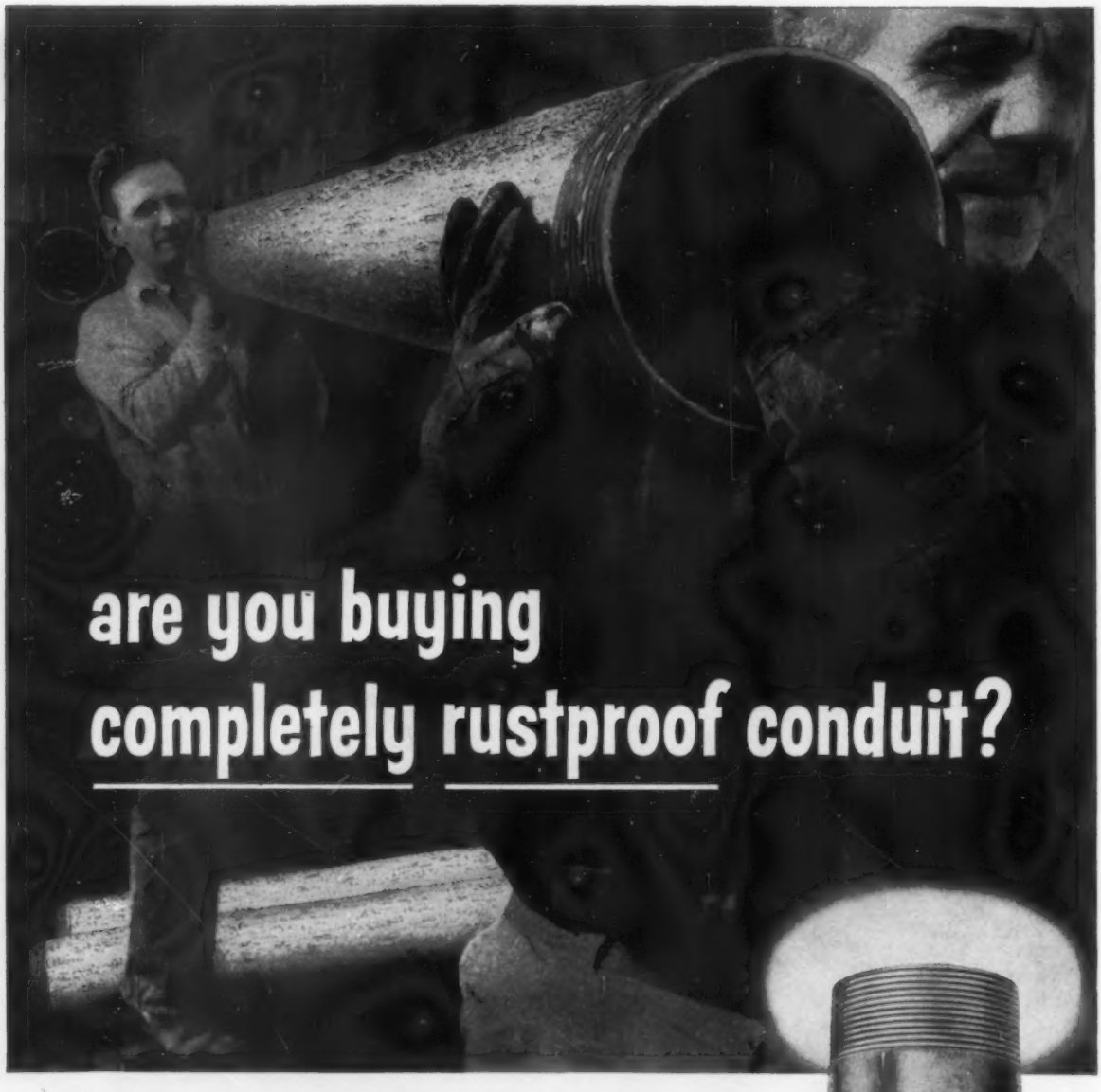
Circuit Breakers

Substations



Super-Seal and Texrope are Allis-Chalmers trademarks.

ALLIS-CHALMERS



are you buying completely rustproof conduit?

PITTSBURGH STANDARD HOT-DIP GALVANIZED CONDUIT IS RUSTPROOF FROM END TO END

The zinc chromate coating that characterizes Pittsburgh Standard Hot-Dip Galvanized Conduit doubles the protective life of the galvanizing. And the hot-dip galvanized and coated threads stay bright, clean and sharp. No chasing or cleaning required even when conduit lies in storage for months. All thread protectors are color-coded for easy size identification.

For ease in handling, Pittsburgh Standard conduit is banded into master lifts, and the individual bundles of each size are identified by color-coded bundling tapes. All these features are yours at no extra cost when you buy Pittsburgh Standard. Ask for them at your electrical distributor's. *Pittsburgh Standard Conduit Company, Verona, Pa.*

PLANTS AT VERONA AND MORRISVILLE, PA.

RIGID STEEL CONDUIT · ELECTRICAL METALLIC TUBING · ELBOWS · COUPLINGS · FITTINGS

The Profit Line for '59 **ALLIS-CHALMERS**

ALLIS-CHALMERS

Small size saves panel space.

ALLIS-CHALMERS

A-C Introduces New Static Relay

COLLEGE STATION, Texas, April 13 — Over 300 relay engineers and scientists witnessed another example of the Electronic Age today when Allis-Chalmers introduced a new static protective relay. The new development was disclosed in an engineering paper presented by John Baude, Allis-Chalmers engineer, before the Twelfth Annual Conference for Protective Relay Engineers.

The new relay, designed for industrial switchgear application, is the first major departure from conventional relay construction in 50 years.

NO MOVING PARTS

Of particular significance is the elimination of all moving parts through the use of semi-conductors such as transistors, diodes, thermistors, and varistors. Use of these components combined with a printed circuit has enabled Allis-Chalmers en-

FIRST completely static protective relay!

. . . available in Allis-Chalmers switchgear

This highly reliable *new* protective overcurrent relay has no moving parts . . . it's static, and it's only ⅓ the size of conventional relays.

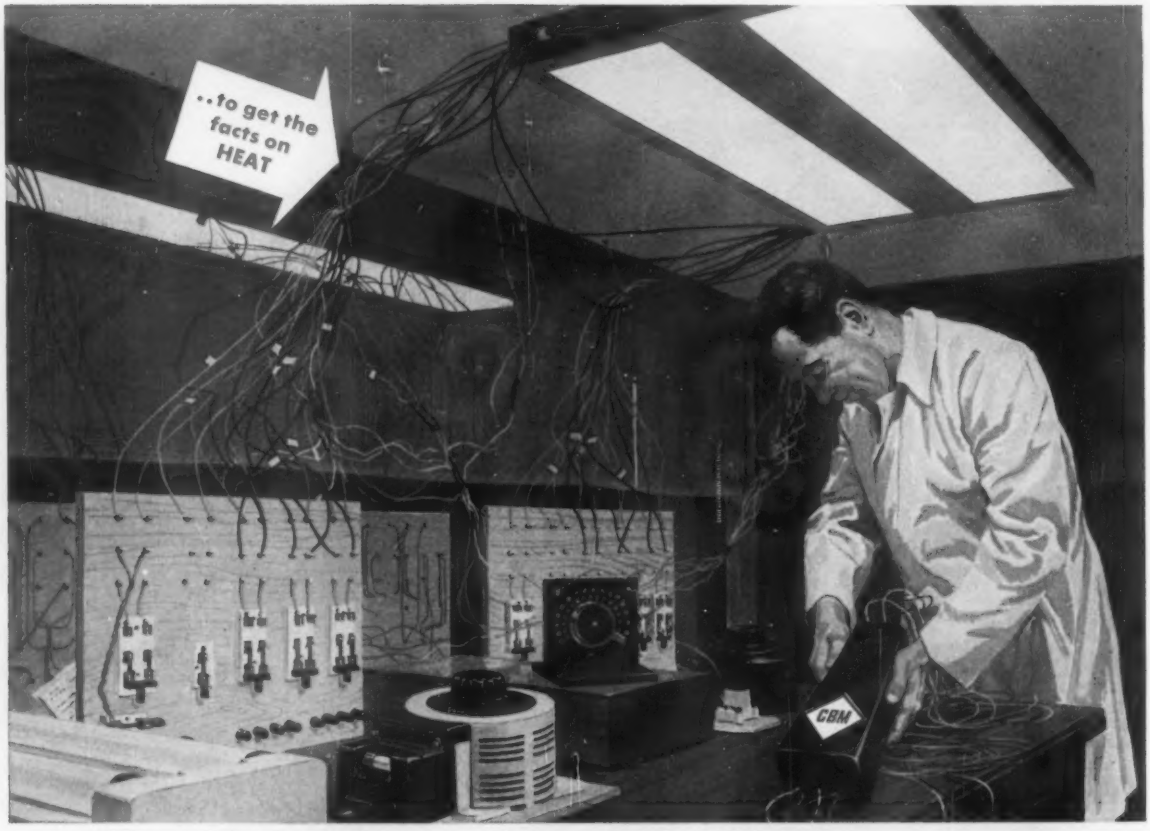
Employing transistors, printed circuits, and other electronic components encased in epoxy-resin, A-C static relays are shock and moisture resistant. They're unaffected by temperature changes, operate with low burden, and have instantaneous reset feature. Quick plug-in construction makes replacement easy.

Want more protective relay-equipped switchgear facts? Contact your nearby A-C office or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-1157-EC

HOW CBM ASSURES YOU BETTER BALLAST VALUE

Heat measurement study under way at ETL for joint CBM-RLM-NEMA committee . . . aims to improve fixture and ballast heating conditions . . . assure better performance and service



This maze of wires above is needed to connect with thermocouples in fixtures, ballasts and other parts, so temperatures can be measured at different points. Screening shields break up drafts from air conditioning, help keep ambient constant.

NEW streamlined fluorescent fixtures, new high output lamps and space-saving mounting trends have often brought higher channel ambient temperatures . . . *and problems to user and installer!*

To deal with them, Certified Ballast Manufacturers led in setting up a joint technical committee with RLM and NEMA fixture makers. For this group, ETL is measuring temperature at 50 different points in representative fixtures, to try to pinpoint the part each of the lighted fixture components plays in the total temperature rise. Already progress has been made . . . and more is expected.

But this is just one contribution by CBM toward better ballast value. Behind it all is the CBM specification which assures quality performance, including:

Long lamp life • High power factor • Positive starting • Lasting service • Peak lighting performance . . . with conformance to spec checked and certified by ETL. Naturally, CBM Ballasts are UL listed!

Get the full story on why it pays to specify fluorescent fixtures equipped with ballasts that are Certified CBM. Write for: "To Insure Your Lighting Investment", Certified Ballast Manufacturers, 2118 Keith Building, Cleveland 15, Ohio.

CBM CERTIFIED by ETL

CERTIFIED BALLAST MANUFACTURERS

2118 KEITH BUILDING
CLEVELAND 15, OHIO

Participation in CBM is open to any manufacturer who wishes to qualify

4-59

NAUGATUCK PARACRIL OZO

THE OIL-RESISTANT, OZONE-RESISTANT NITRILE RUBBER

Now–the finest wire jackets can be Colored!

FOR SALES APPEAL • FOR SERVICE EASE

New Paracril OZO—a superior rubber compound developed by Naugatuck—makes possible *new eye appeal, new ease of identification.* And it outperforms standard wire jacket compounds many other ways, too!

Compare new PARACRIL OZO with other wire jacket rubbers. Prove for yourself, new PARACRIL OZO gives:

- significantly superior ozone resistance
- greater fuel and oil resistance
- much greater abrasion resistance than standard jacket compounds
- excellent processability, with particularly fast extrusion
- *permanent retention of bright colors!*

If you are not already using PARACRIL® for your wire jacket compounds or similar products requiring such properties, chances are 1000 to 1 it's because you haven't yet *tried* PARACRIL OZO.

Why *not* try it—soon. Contact your nearest Naugatuck representative at the address below.

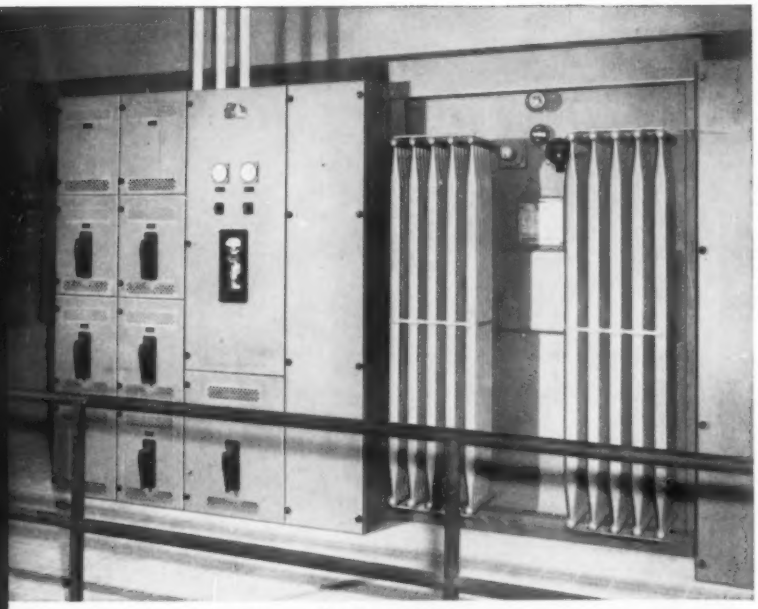
Naugatuck Chemical

Division of United States Rubber Company 834P Elm Street Naugatuck, Connecticut

US RUBBER

Rubber Chemicals · Synthetic Rubber · Plastics · Agricultural Chemicals · Reclaimed Rubber · Latices · CANADA: Naugatuck Chemicals Division, Dominion Rubber Co., Ltd., Elmira, Ontario · CABLE: Rubesport, N. Y.

WAGNER Close-Coupled Transformer permits compact load-center for TRANE COMPANY



This Wagner 1000 kva Noflamol close-coupled Transformer is installed in Trane Company's new $1,250,000 Engineering Building.

One of the many unusual features of The Trane Company's new Engineering Building at LaCrosse, Wisconsin, is a display room for the air conditioning equipment that serves the building. A full glass wall in this room permits visitors to view the Trane CenTraVac water chiller and master control panel, the pump room and the unit substation that handles the power load distribution for the building.

A Type JP 1000 kva Wagner close-coupled transformer was chosen to power the unit substation. Wagner close-coupled transformers fit flush against the switchgear enclosures, eliminating throats and saving space. Connections are made at the bushings on the sides of the transformer. Bushing heights are designed to give ample room for connection to switchgear or busses and eliminate need for special throats to match special switchgear. These noninflammable liquid-filled transformers are available in ratings from 500 through 2000 kva.

Consult your nearby Wagner Sales Engineer about the complete Wagner line of Unit Substation Transformers—both liquid-filled and dry-type. Bulletins TU-205 and TU-214 give full information on Wagner Unit Substation Transformers for industrial power needs. Write for your file copy today.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

WT58-2

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Wagner Electric Corporation
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

Diamond has all 3 portable cords

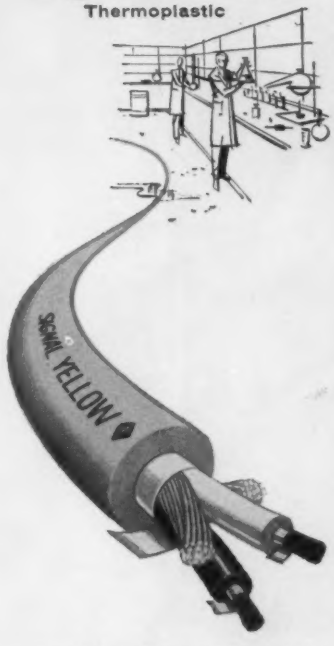
Red-D-Prene®
Neoprene Sheathed

for hot, oily locations

Black Diamond
Rubber Sheathed

for general purpose use

Signal Yellow
Thermoplastic



for all locations where heat is no problem

Red-D-Prene for mill and plant use is designed with tough, oil, heat and flame resistant Type MD (Mill Duty) neoprene jacket in industrial red for ready identification.

Black Diamond has durable rubber jacket protecting against alkalies, acids and moisture. Very flexible construction prevents kinking in service.

Signal Yellow has a jacket of yellow thermoplastic that is quickly seen . . . clean to handle . . . smooth sheath will not readily collect dirt. Easy to pull.

DIAMOND IS ALSO A PRIME SUPPLIER OF

DTW Small Diameter Building Wire

DTX® Non-Metallic White Sheathed Cable

Type SE Service Entrance Cable (Armored & unarmored)

DUF® Type UF

ABC Armored Bushed Cable

Range Cord Sets

Trade Mark ®

DIAMOND
WIRE and **CABLE** Company
Sycamore, Illinois
WAREHOUSE: BIRMINGHAM, ALABAMA

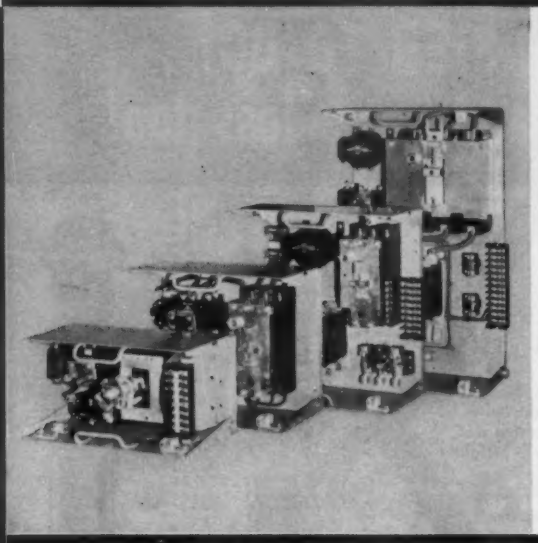
CUTLER-HAMMER

First in compactness • flexibility • and wiring simplicity

8-Hi Unitrol packs more control into less space

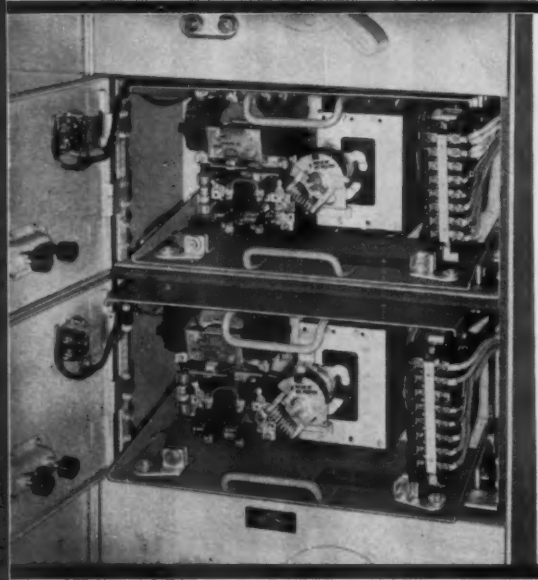
Each *side* of a single Unitrol *section* will hold *eight* size 1 control units . . . or *five* size 2 units . . . or *four* size 3 units. And these are *NOT* "stripped-down" units. The new compact design provides space for optional components such as control circuit fuses, control transformer, terminal boards, three-coil overload relays, and pushbuttons and indicating lights.

8—HI UNITROL®



8-Hi Unitrol offers extra control center flexibility

Control units for the new 8-Hi Unitrol are available in both the standard and new compact design for maximum selectivity and flexibility. Add to this the modular construction and see how easily the control units can be combined to create a flexible, space-saving control center. On-the-job modifications are easily made . . . 8-Hi Unitrol keeps pace with changing requirements.



8-Hi Unitrol is easier, safer to install

Available in types A, B, and C construction with Class 1 or 2 wiring, you can select the 8-Hi Unitrol that affords the greatest installation economy. Cost-cutting, time-saving features include U-shaped control units assure wide-open visibility . . . no buried components. "Safety-lock" test position insures safe wiring and testing. "Plug-in" power contacts are self-aligning . . . no hazardous manual adjustments.

Be sure you have all the facts about Cutler-Hammer 8-Hi Unitrol . . . its many extra features assure you more economical installations, and the most dependable performance. Write today for the new descriptive Bulletin EN142-Q241. Cutler-Hammer Inc., Milwaukee 1, Wis.

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wis. • *Division:* **Airborne Instruments Laboratory.** • *Subsidiary:* **Cutler-Hammer International, C. A.**
Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation.

EASIER TO DO... and costs less too!

B-M
INDENTER FITTINGS and TOOLS

Here is the combination that is unbeatable when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws.

A few more of the plus features of B-M fittings are Concrete tight — Vibration resistant — Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance — Extra heavy positive bonding locknuts — Smooth rounded edges or bushed throat type connectors that prevent insulation damage — All steel construction with extra heavy gauge wall thickness.

Red Throat
BM-218
½" Connector

Red Throat
BM-228
¾" Connector

Red Throat
BM-238
1" Connector

BM-41
½" Coupling

BM-42
¾" Coupling

BM-43
1" Coupling

BM-51
½" Offset Connector

BM-21
½" Connector

BM-22
¾" Connector

BM-23
1" Connector

BM-No. 600
Changeable Jaw Indenter

BM-No. 1000
Handvise for ½", ¾" and 1" E. M. T.

BM-No. 100
Cutter for ½", ¾" and 1" E. M. T.

BM-No. 607
½" Indenter
BM-No. 608
¾" Indenter

UL

TELESCOPE BM SYSTEM

All B-M indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

BRIEGEL METHOD TOOL CO.
GALVA • ILLINOIS

Make Bull Dog your Pet Tape!

There's a
BULL DOG TAPE
for every purpose

- **FRICTION**
- **RUBBER**
- **PLASTIC**

BULL DOG TAPE is a man's best friend! Delivers thoroughbred performance every time. It goes on fast . . . sticks tight and stays tight. Splices neatly . . . extra strong and non-ravelling. High dielectric strength for complete all-around electrical protection. BULL DOG is *tough*, too . . . resists weather and moisture . . . stands up longer on the job!

Sold only through verified wholesalers

Another quality product of

BOSTON WOVEN HOSE & RUBBER COMPANY
DIV. OF AMERICAN BILTRITE RUBBER CO., INC.
BOSTON 3, MASS.

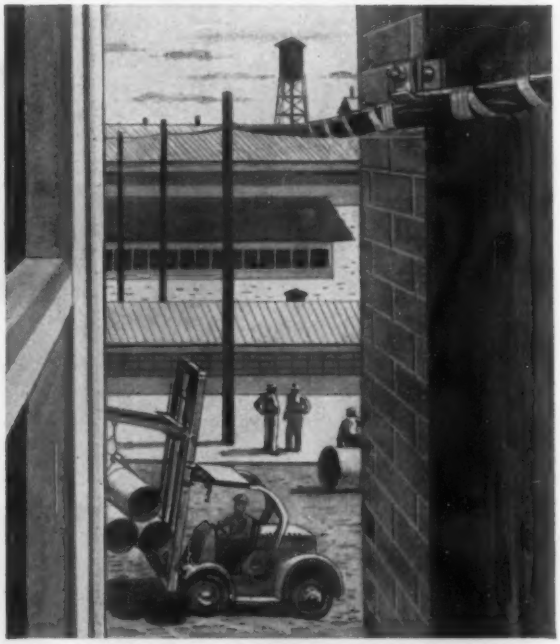
Also manufacturers of Garden Hose · Nozzles · Matting · Stair Treads

LIGHTWEIGHT K&W ALUMINUM INITIALLY, CUTS

Costs 20% less than copper with equal current carrying capacity!

SIMPLE CONNECTIONS

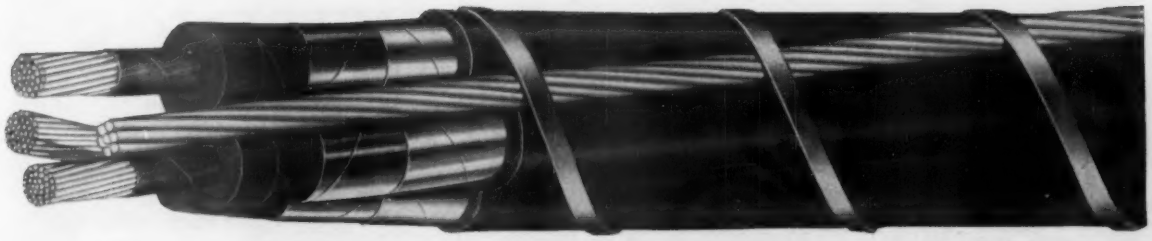
Reverse lay provides simple and fast connections because the conductors can be easily separated to make taps and connections. Tapping is quick and easy.



REDUCES CLEARANCE SPACE

Unlike open wire construction, compact preassembled aerial cable needs little clearance space near buildings and other structures. One cable takes the place of many.

AERIAL CABLE COSTS LESS INSTALLATION COSTS



FASTER INSTALLATION

Due to its light weight, aluminum aerial cable can be installed to the same sags as copper cable. It provides as much clearance, and reduces the tension at pole supports. Additionally, this reduced weight in some cases permits reduction of the messenger size. Less congestion on poles; decreased pole height when used for joint construction with telephone company; improved voltage regulation due to reduced reactive drop.

SAVE on first costs, save on labor and maintenance expenses now with KW aluminum aerial cable. KW preassembled aerial cable is available in both reverse lay and unilay in either aluminum or copper. For immediate service or more detailed information, call the Kaiser Aluminum sales office or KW distributor listed in your telephone directory.

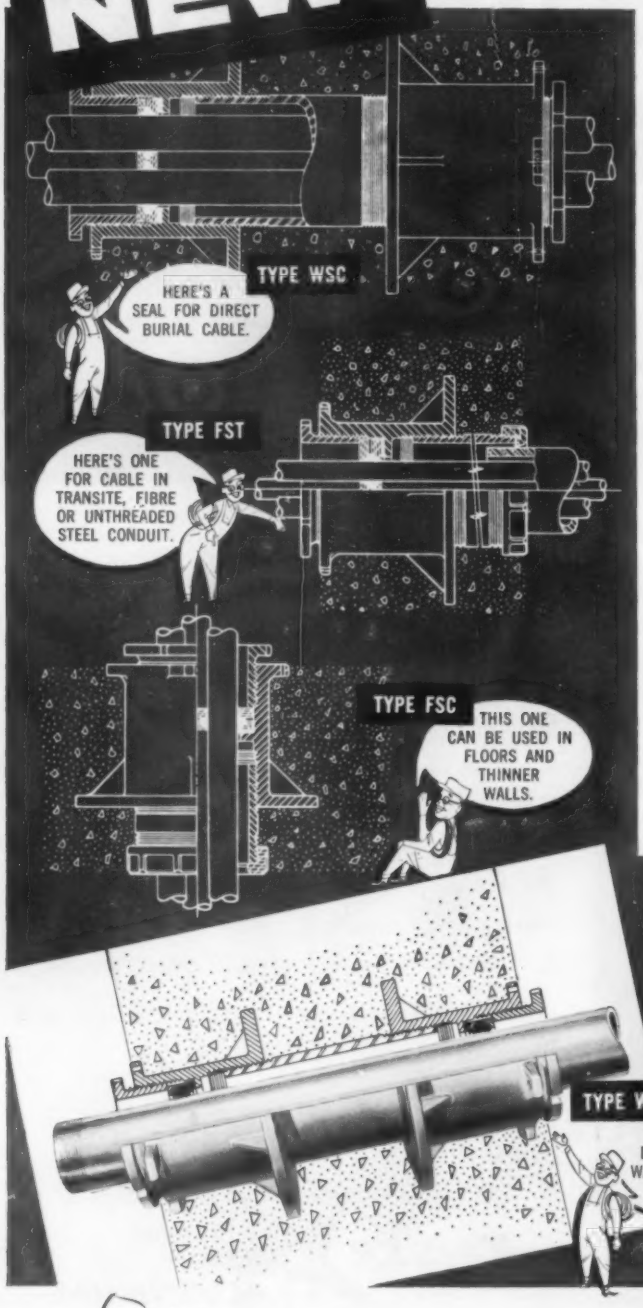
Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California.

KAISER ALUMINUM

"IF IT CARRIES CURRENT, KW CARRIES IT!"

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local TV listing.

NEW! a complete line of O.Z. WATERTIGHT ENTRANCE FITTINGS for Conduit or Cable


TYPE WSC
HERE'S A SEAL FOR DIRECT BURIAL CABLE.
TYPE FST
HERE'S ONE FOR CABLE IN TRANSITE, FIBRE OR UNTHREADED STEEL CONDUIT.
TYPE FSC
THIS ONE CAN BE USED IN FLOORS AND THINNER WALLS.
TYPE FSK
TRY THIS FOR SEALING CONDUIT IN FLOORS AND WALLS.
TYPE WSK
THIS ONE'S FOR CONDUIT WALL ENTRANCE SEALING.

End leakage problems once and for all! O.Z.'s new wall and floor entrance fittings for installation in concrete provide a positively watertight seal around conduit or cable at any pass-through point! Use them with threaded or unthreaded steel conduit, fibre or Transite® conduit, or exposed cables of varying number and sizes. Gland-type sealing assemblies, with pressure bushings, may be tightened at any time. Fittings accommodate conduit ranging from ¾" to 6". Standard types, sizes available from stock. Specials made to order.

For more information on fittings and other O.Z. products, call your local distributor, or write to the company.

® Registered trade-mark of Johns-Manville Corp.

O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND STREET • BROOKLYN 17, N. Y.

- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- CONDUIT FITTINGS
- INTERLOCKED ARMOR CABLE FITTINGS

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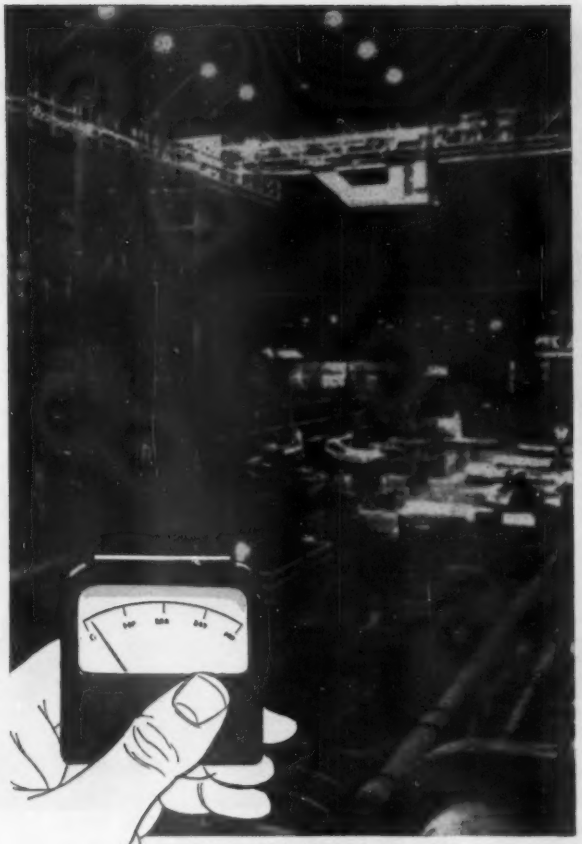
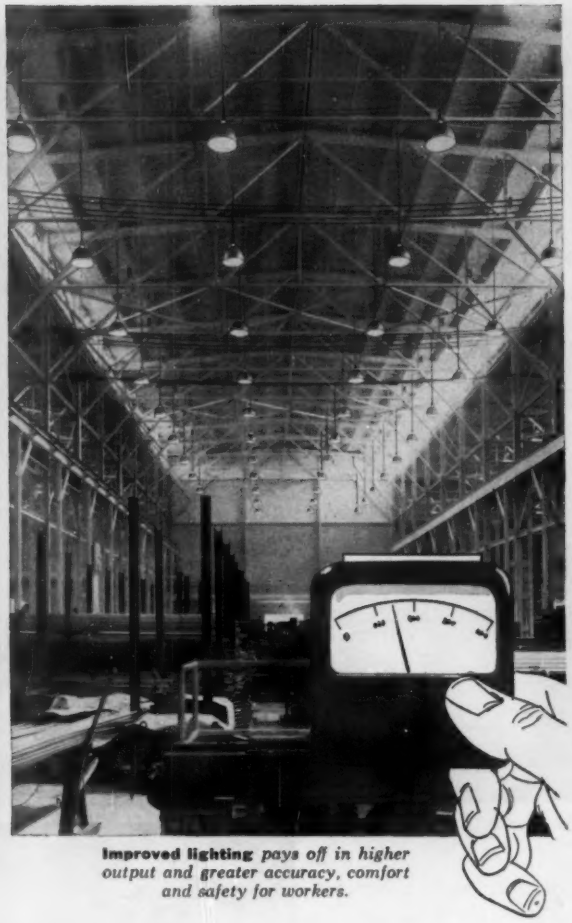


Dull, dreary lighting *cuts down worker efficiency, causes eye strain, makes many work tasks hazardous.*



Improved lighting *pays off in higher output and greater accuracy, comfort and safety for workers.*

Lifting the lighting level

In the picture on the right, those Abolite fixtures provide a high level of comfortable, glareless light throughout this high bay building. 18% of the light is directed upward through Abolite's open top, washes out the deep shadows, gives lamps a soft background. 35° shielding of lamp practically eliminates glare.

Open-top design also gives Abolite high bay units a self-cleaning action. Air circulates through the fixture, sweeps reflecting surface clean.

Choose from several Abolite uplight units for high bay lighting: 18" and 24" Alzak aluminum fixtures for 400 and 1000 watt mercury lamps; and 14" and 18" fixtures for 300-500 watt incandescent lamps (ideal for gymnasium lighting). For full information, write *Abolite Lighting Division, The Jones Metal Products Company, West Lafayette, Ohio.*

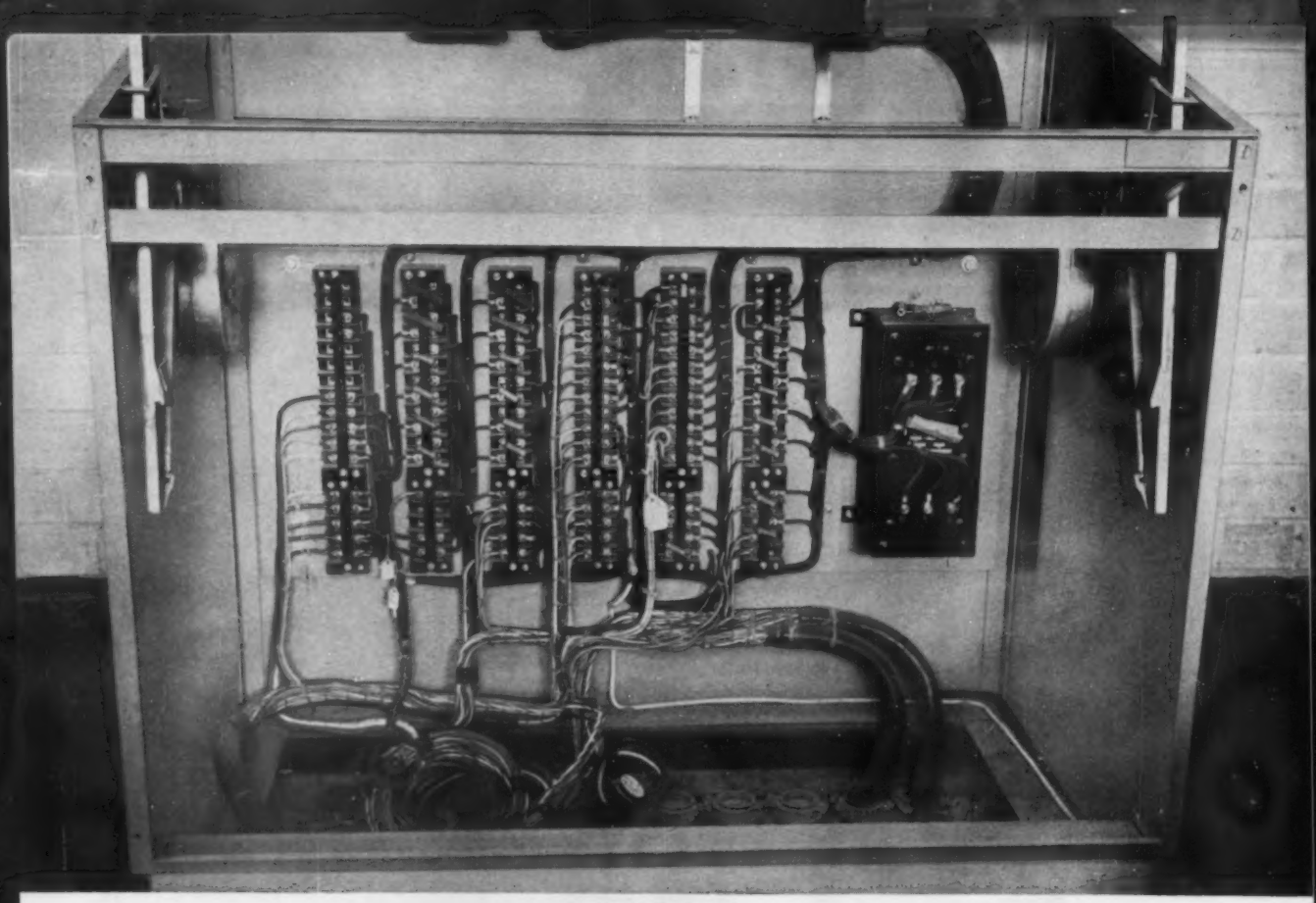
Abolite Cat. No. HMFAU-2400 Alzak aluminum uplight fixtures with 400 watt white reflector Mercury lamps.

eye-fi RE/LIGHTING

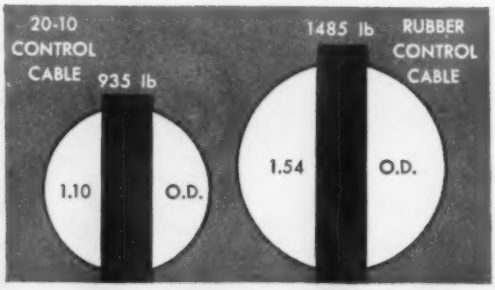
ABOLITE Lighting

THE JONES METAL PRODUCTS COMPANY

West Lafayette, Ohio



Jobs like this are made simpler from start to finish with Anaconda 20-10 Control Cable. All wiring shown in this control desk of a 15,000 hp motor is Anaconda 20-10 Control Cable.



Comparison of O.D. and Weight per 1,000 Feet of No. 10 Awg 19 Conductor Cable. Ease of installation is inversely proportional to the weight and diameter of the cable. This comparison shows 20-10 to be lighter in weight and smaller in diameter than a conventional rubber control cable. Thus Anaconda 20-10 Control Cable saves on installation costs.

Anaconda 20-10 Control Cable's composite design takes full advantage of both polyethylene and Densheath, giving full IPCEA recommended insulation thickness of 30 mils for 600-volt service.

ANACONDA'S SUPERIOR 20-10 THERMOPLASTIC CONTROL CABLE SIMPLIFIES CABLE NEEDS!

ONE CABLE for practically all 600-volt control cable applications – that's Anaconda's versatile, new thermoplastic 20-10 Control Cable. This means simplification of all your control cable needs – makes ordering, stocking, and installation easier, quicker, and more economical.

Conductors are insulated with 20 mils of polyethylene and covered with 10 mils of Densheath® (PVC). This composite design takes full advantage of the best features of both thermoplastics, and provides full IPCEA recommended insulation thickness of 30 mils for 600-volt service.

POLYETHYLENE conductor insulation provides:

high dielectric strength
low moisture absorption
low power factor
protection against electro-endosmosis
high insulation resistance
low specific inductive capacity
ozone resistance
resistance to chemical attack

DENSHEATH (PVC), as both insulation and covering, provides:

good dielectric properties
excellent flame resistance
excellent coloring ability
excellent abrasion resistance

The application of the over-all Densheath jacket to the cabled composite insulated and covered conductors provides a product that can be installed aerially . . . in conduits . . . in trays or ducts . . . directly buried. Anaconda 20-10, then, is the superior control cable that can offer all the benefits of standardization to industry.

For 1000-volt service, Anaconda has adapted 20-10's design to produce a cable with 30 mils of polyethylene and 15 mils of Densheath (PVC).

Talk to the Man from Anaconda about 20-10, or 30-15, control cables for your applications. And be sure to write for Bulletin DM-5844 for the full technical data on Anaconda 20-10 Control Cable. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

59201

Use this coupon to get your copy of an important New Booklet on
ANACONDA 20-10 CONTROL CABLE
full technical data

Anaconda Wire & Cable Company
25 Broadway
New York 4, New York

GENTLEMEN:

Please send me a copy of Bulletin DM-5844 containing full technical information on Anaconda 20-10 Thermoplastic Control Cable.

Name .....

Company .....

Address .....

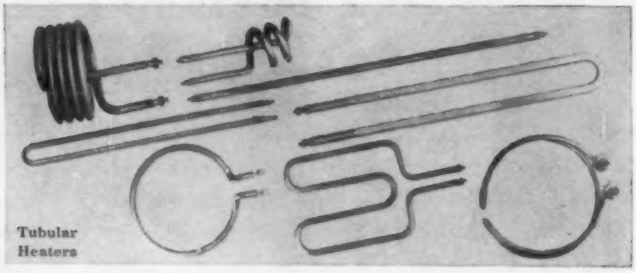
City ..... **Zone**..... **State**.....

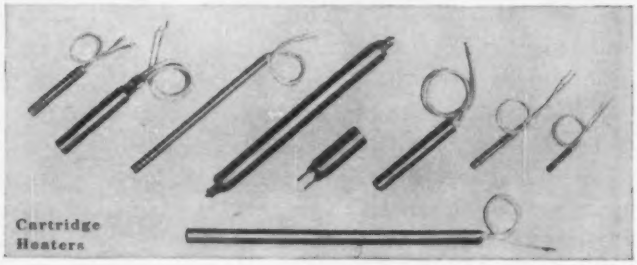
See the man from

ANACONDA®

for 20-10 thermoplastic control cable

Call your CHROMALOX Man for the heating answers





These 3 basic CHROMALOX heaters provide answers to just about any heating problem

Strip Heaters . . . that quickly and easily bolt or clamp to platens, dies, kettles, tanks, pipes, rolls, drums, ovens and air ducts. Lengths from 4 to 96 inches, widths from ¾ to 2½ inches, with cross section curving or lengthwise bending. Available with brazed-on fins.

Tubular Heaters . . . that clamp on, fit into machined grooves, cast into metals, immerse in liquids, install in ovens and ducts. Straight lengths or factory-formed to nearly any contour. Lengths from 6 inches to 30 feet. Triangular or round cross section. Available with brazed-on fins.

Cartridge Heaters . . . that smoothly fit standard drilled holes in dies, platens, molds, extrusion and injection barrels. Special leads available for protection against flexing action, abrasion, moisture or vapors. Diameters from ⅜ to 1 19/64 inches, lengths from 1⅝ to 25⅜ inches.

Versatile Chromalox electric heaters are available in sheath materials and wattages to match almost any application to 1100°F. Easy to install, they are fast, clean, safe and economical.

Your Chromalox Man can help you determine the one that best answers your specific problem. He's backed by the world's largest factory stock of industrial heaters, ready for immediate shipment. Why not give him a call. You'll find his phone number listed at the right.

Our new Catalog 60 provides detailed product information and suggests numerous applications for the complete line of Chromalox electric heaters for industry. If you have not yet received a copy, please let us know.

1801

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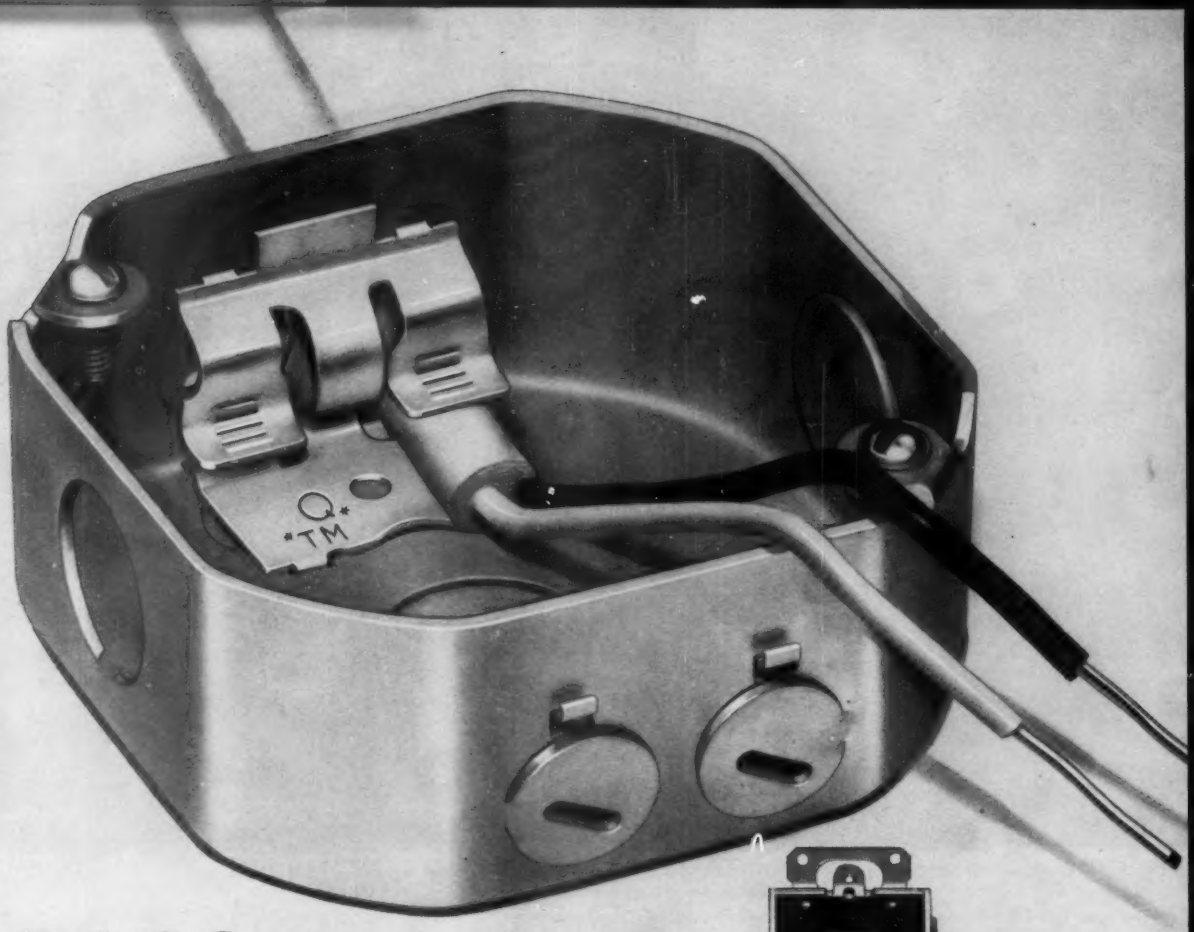
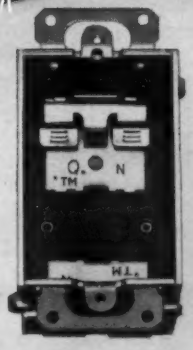
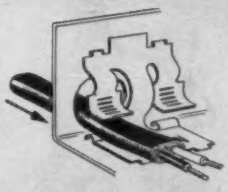


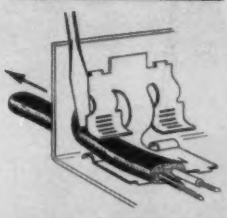
RACO screwless "Q*" Quick-Clamp saves time on the job



"Q" Quick-Clamp available in RACO switch or outlet boxes



Cable moves freely into clamp and is gripped tightly



To back-off cable, release clamp pressure with screwdriver

With RACO's new "Q" Quick-Clamp you can install non-metallic sheathed cable in seconds—without clamp screws. Simply push the cable through "Q" Quick-Clamp. Cable is held firmly in place, can't be pulled out until clamp is released. To release the cable, apply a little pressure under the clamp with your screwdriver. With the new "Q" Quick-Clamp there will be no more lost time tightening and loosening cable clamp screws . . . no more stripped screw heads.

And . . . you'll save an hour or more on the average job (60 to 100 boxes per house). Your RACO Distributor has the new "Q" Quick-Clamp Switch and Outlet Boxes. (Exceed Underwriter Laboratories' tests; are fully protected by patents.) See them and try them now.

*Trademark

RACO **ALL-STEEL EQUIPMENT INC.** Aurora, Illinois

Maximum flexibility in space utilization is achieved at Reynolds through partitions that easily can be moved to expand or decrease area sizes. This can be accomplished without making costly changes in the lighting system. The Curtis wall-to-wall ceiling of light provides 80 ft. candles of maintained illumination. Attractive Hexcel Honeylite aluminum diffusers complement the inviting decor.

How a special Curtis Lighting system saved Reynolds Metals $50,000...

Here is the new home of Reynolds Metals Company, Richmond, Va. It is dramatically placed at the end of a reflecting pool bordered by willow oaks. The classic beauty of the building is enhanced by this unusual setting. Architect: Skidmore, Owings & Merrill; Consulting Engineer: Ebasco Services, Inc.

Unique all-aluminum folding grids in 100 sq. ft. units cut installation time 8,000 man hours . . . provided wall-to-wall illumination with low brightness quality

Installing a lighting system so flexible it can adapt to any internal building change without relocation is quite a feat. But when that is accomplished at important savings it calls for exceptional engineering ingenuity. That's what Curtis Visioneers achieved with a special custom-made aluminum folding grid system at Reynolds Metals Company, Richmond, Va. The unique folding "packages" made it possible to install 100 sq. ft. of lighting at one time. Result: a saving to Reynolds of an estimated 8,000 man hours, or approximately $50,000. A wall-to-wall ceiling of light was created with a beautiful satiny aluminum lighting tone of low brightness quality. Over-all ceiling illumination solved the problem of how to obtain stationary lighting for a 100,000 sq. ft. area, even though wall partitions would be moved in the future. Write today for the name and address of the representative in the principal city nearest you. Curtis-AllBrite Lighting, Inc. Chicago, 6135 W. 65th St. South San Francisco, 352 Shaw Road.

CURTIS All-Brite

Large office areas are as effectively illuminated as small areas with a high degree of visual comfort assured. In this special Curtis grid installation, aluminum materials were used throughout. Maintenance features of the system include ease of relamping, ready access to wiring, simple replacement of ballasts.

Specify McGILL® *Levolier*® switches

...for guaranteed precision plus durability

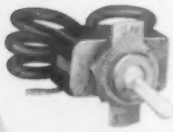
The high standards of design, craftsmanship and material selection make it possible to guarantee No. 41 LEVOLIER switch unconditionally against failure in lighting circuits. This extra quality is reflected in the performance of all LEVOLIER switches.

It pays to specify the best to avoid frequent and costly replacement. LEVOLIER canopy, toggle, push button and momentary contact switches are recognized for their reliability and long life.

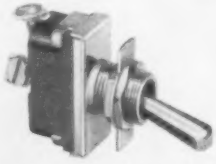
All are Underwriters' Laboratories inspected.

UNCONDITIONALLY GUARANTEED No. 41 single-pole, single-circuit, universal lever switch 6 amp. "T" 125V—3 amp. 250V. Only ⅝" thick, it is ideal for conduit box and canopy mounting for lighting and FHP motor control.

No. 100 single-pole, 15 amp. 125-250V, 1 HP 120-240V AC, normally "OFF" momentary contact switch. 1 amp., 125V—½ amp., 250V DC. Especially suitable for limit and safety control of industrial machinery.



No. 25 toggle switch carries a 6 amp. "T" 125V, 3 amp., 250V rating with an S.P.S.T. double-break mechanism. 1/3 HP AC 120-240V. Ideal for panel board, FHP motors, appliances, power tools, etc.



No. 90 ¾ HP capacity, 15 amp. 125V, 10 amp. 250V toggle switch with an S.P.S.T. mechanism. Designed for AC operation. Also carries 20 amp. 125V AC non-inductive load for heater applications. Also available in two circuit with center off and no off. Choice of terminals.

No. 1901. Basic 30 amp. momentary contact switch rated 30 amp. 125 or 250 V AC, 1 HP 125 V—2 HP 250 V AC, 2A 125 V—½A 250 V DC. Available SPST NO or NC, SPDT and SPST 2 ckt. with six standard actuators. Size 1.876" x .812" x .500".

No. 71 single-pole, single circuit, universal lever switch . . . the thinnest 6 amp. "T" 125V—3 amp. 250V switch of its kind on the market today — only 15/32" thick. Also with push button.

For complete descriptions of the entire McGILL line of switches, sockets, portable lampguards and other electrical specialties, write for catalog No. 84.

AVAILABLE FROM YOUR ELECTRICAL WHOLESALER

engineered electrical products

McGILL®

precision needle roller bearings

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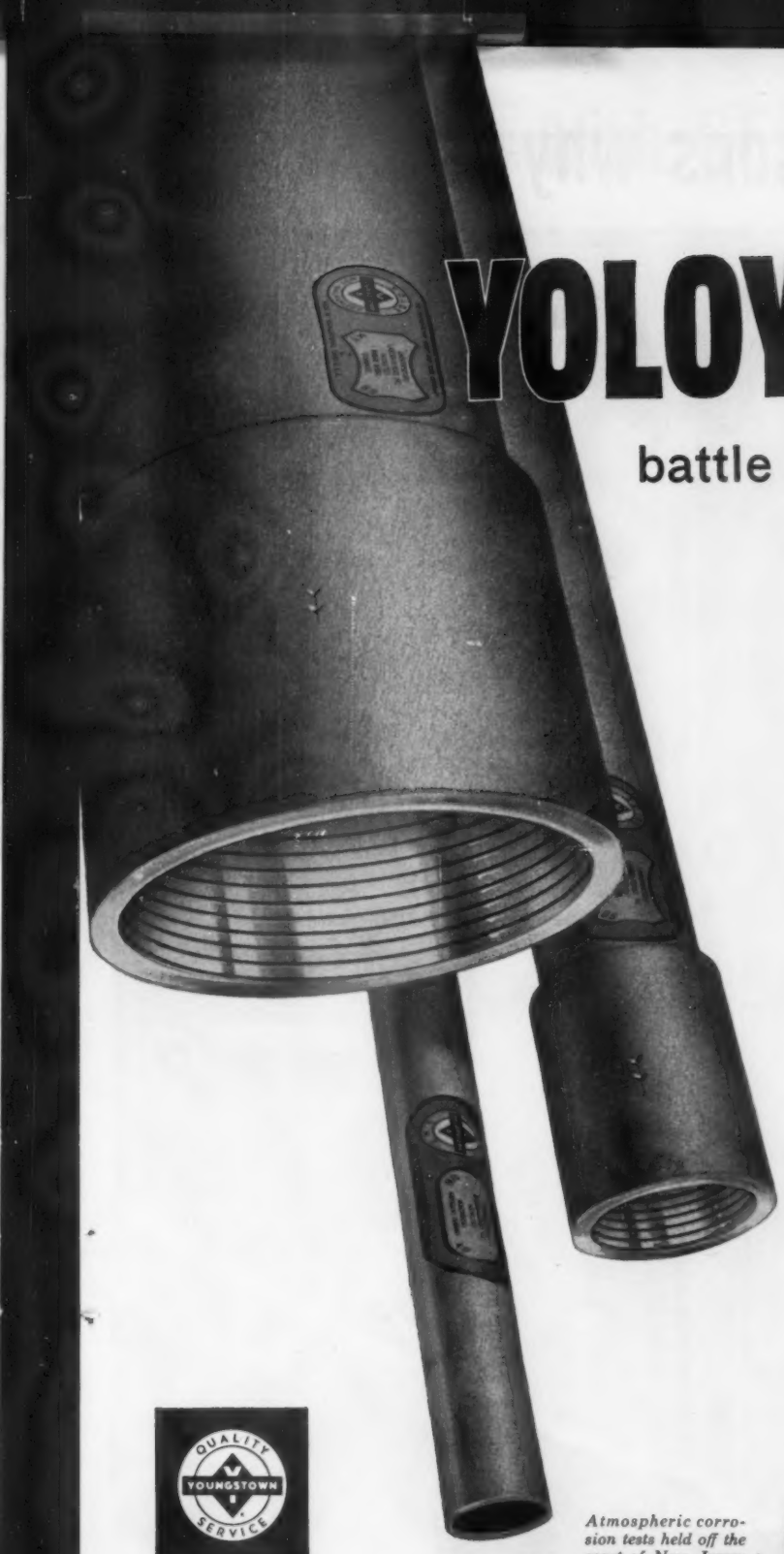


YOLOY CONDUIT AND E.M.T.

battle corrosion...last longer

Specify Yoloy (nickel-copper low alloy) steel conduit to handle applications where greater strength, corrosion-resistance, and weldability are required.

Yoloy Conduit should be specified for electrical installations where corrosion is expected to be more severe than normal. Research has proved Yoloy resists corrosion 4 times longer than carbon steel in marine and industrial atmospheres.

Yoloy steels have proved highly resistant to corrosion in oil fields, coal mines, railroad cars, motor trucks and highway construction equipment for over a quarter-century. Long-time tests and actual installations have proved that Yoloy pipe lowers costs when used for salt water lines, oil wells, industrial installations and corrosive soils.

Corrosion studies conducted for 14 years in 13 different soils show that Yoloy has 19% less pitting and 36% less weight loss than carbon steel—and 10% less pitting and 23% less weight loss than wrought iron. This proved corrosion resistance greatly lengthens the life of coatings—galvanized or enameled—on Yoloy Conduit.

Check with your Youngstown Representative and get the complete story on how Yoloy Conduit and E.M.T. can easily meet your most exacting job specifications.

The Youngstown Sheet and Tube Company, Youngstown, O. Carbon, Alloy and Yoloy Steel.

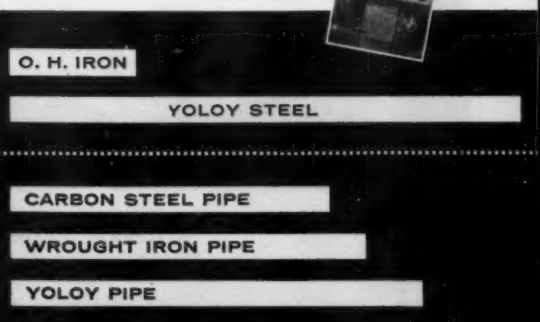
Send for free technical bulletin on Youngstown Yoloy Conduit and E.M.T.

QUALITY YOUNGSTOWN SERVICE

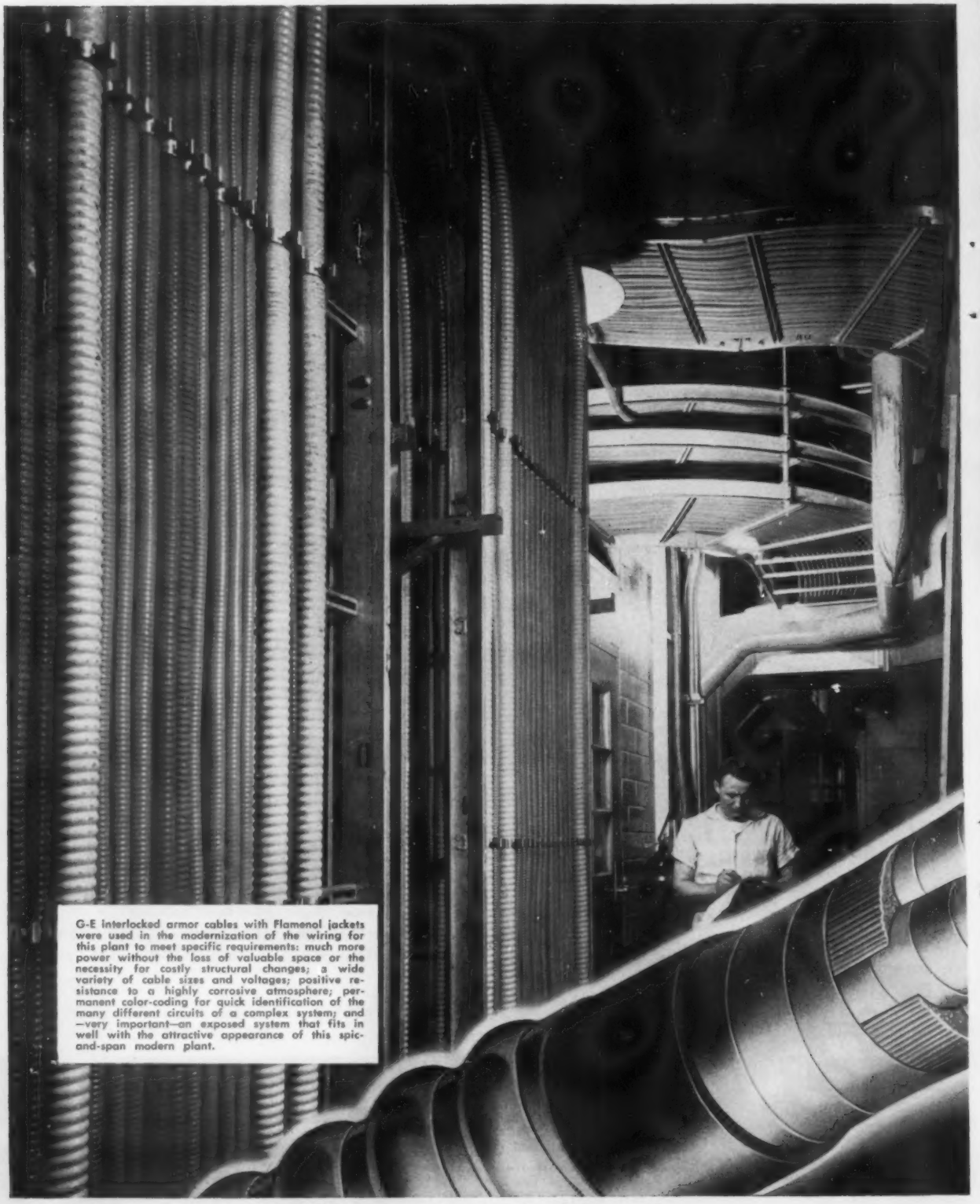
Youngstown

Atmospheric corrosion tests held off the coast of New Jersey revealed Yoloy steel will last four times longer than open-hearth iron.

Expected life increase of Yoloy steel over carbon and wrought iron in corrosive soils. Studies were conducted over a 14-year period in 13 different soils.



3 Reasons why it pays to



G-E interlocked armor cables with Flamenol jackets were used in the modernization of the wiring for this plant to meet specific requirements: much more power without the loss of valuable space or the necessity for costly structural changes; a wide variety of cable sizes and voltages; positive resistance to a highly corrosive atmosphere; permanent color-coding for quick identification of the many different circuits of a complex system; and —very important—an exposed system that fits in well with the attractive appearance of this spic-and-span modern plant.

modernize with GENERAL ELECTRIC INTERLOCKED ARMOR CABLE

Electrical contractors who use a G-E interlocked armor cable system for plant modernization, recognize these important features that help them and their customers:

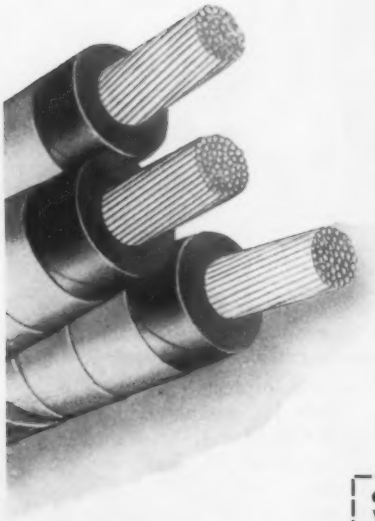
1. Lower total installed cost compared with other conventional methods—savings as high as 50%.
2. Reduced space requirements—sometimes as much as 50%.
3. Ease of installation, because—
   a. Cable can be run around corners, over beams in congested areas, and through or on structural members.
   b. Long, continuous runs of cable are easy . . . there are fewer splices and no pull boxes are needed.
   c. G-E VCI cable weighs as much as 2/3 less than conventional cable and conduit installations.
   d. Smaller and/or fewer cables are necessary for a given load—again a saving in material and space.
   e. Complicated splices and terminations are not necessary—potheads are not required indoors, even at 15,000 volts.

G-E interlocked armor cables offer a wide choice of insulations . . . rubber, varnished cambric, thermoplastic, silicone rubber, or asbestos. Ratings for these cables range from 600 to 15,000 volts. The armor may be galvanized steel, aluminum, or bronze.

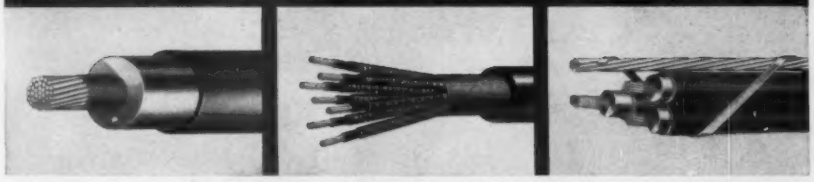
For resistance to corrosive atmospheres, the cable is available with a Flamenol* jacket. These jackets can be supplied in vivid, lasting colors to provide circuit identification. Where the added protection of a Flamenol jacket is not needed, circuit identification can be supplied by colored aluminum armor.

In a G-E interlocked armor system, as well as in all G-E wires and cables, you will find extras that stem from General Electric's vast research facilities and emphasis on engineering and technical skills.

For further information on interlocked armor cable for economical plant modernization, just mail the coupon below. *Registered Trade-mark General Electric Company



Other important G-E cables that solve modernization problems



1) Super Coronol* Flamenol Cable—a rubber-type cable designed for power circuits for continuous operation of conductor temperatures of 90 C up to 5000 volts and 85 C in the 5001-15,000 volt range. Insulation has exceptional resistance to ozone, heat, moisture, and aging.

2) Polyethylene Flamenol Control Cable—combines the electrical and moisture-resistant properties of polyethylene with the environmental resistance of Flamenol cable. Small diameter and light weight make it especially suitable for d-c circuits in wet locations and for installations in the air, in underground ducts, and for direct burial.

3) Aerial Cable—lightweight, flexible, easily handled, spliced, and terminated. Eliminates expensive first cost of underground installations, can be easily tapped because of its accessibility.

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Electric Company
Wire and Cable Dept.
Section W225-818
Bridgeport 2, Conn.

Please send me your booklet on G-E Interlocked Armor Cable.

Name .....
Title .....
Company .....
Address .....
City ..... Zone ..... State .....

Here's proof that neoprene jacketing resists flow

Above, you see two samples of electrical cable which were compressed for 8 hours under 75 psi at 302° F. The neoprene-jacketed cable on the left retained its shape . . . retained its protective qualities. The thermoplastic material was severely damaged . . . completely lost its protective qualities.

In addition to resisting distortion under heat and pressure, neoprene jacketing resists ozone, chemicals, aging and weather . . . stays resilient at sub-zero temperatures . . . resists impact, cutting and gouging.

For long, economical service, protect *your* cable with neoprene jacketing. Write for complete facts. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. EC-8, Wilmington 98, Delaware.

DU PONT
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SYNTHETIC RUBBER

NEOPRENE
HYPALON®
VITON®
ADIPRENE®

Better Things for Better Living . . . *through Chemistry*

11 times as much material removed 13 times faster than by hand!

Give your job a finished look with a Black & Decker Bushing Tool.

For the finest, and fastest work always specify genuine Black & Decker forged hammer tools.

Trenches for conduit are a cinch with a Black & Decker Cold Chisel.

Look for Swifty Service at one of B&D's 48 Factory Service Branches. There's one near you.

B&D 1⅛" Hammer drastically cuts cut-through time—labor costs!

Add a Black & Decker 1⅛" Hammer to your tool kit and watch how quickly it opens up your profit margin! It punches through concrete walls in minutes—opens the way for pipe and duct in a fraction of the time it takes by hand.

Plugs into any convenient outlet—the Black & Decker Electric Hammer takes on chipping, gouging, digging, caulking, pointing, and many other jobs! Mail coupon today for a free demonstration on your job-site! If additional information is desired just check the box.

Leading Distributors Everywhere Sell

Look Under "TOOLS-ELECTRIC" in Yellow Pages

Black & Decker®

Quality Electric Tools—Power-built to set the pace

MAIL TODAY FOR FREE DEMONSTRATION

THE BLACK & DECKER MFG. CO., Dept. 1208, Towson 4, Md.
(In Canada: Brockville, Ontario.)

☐ Please arrange a demonstration of your 1⅛" Hammer.
☐ Please send me additional information on tools checked.

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

☐ Portable Grinders ☐ Drills ☐ Shears ☐ Jig Saws

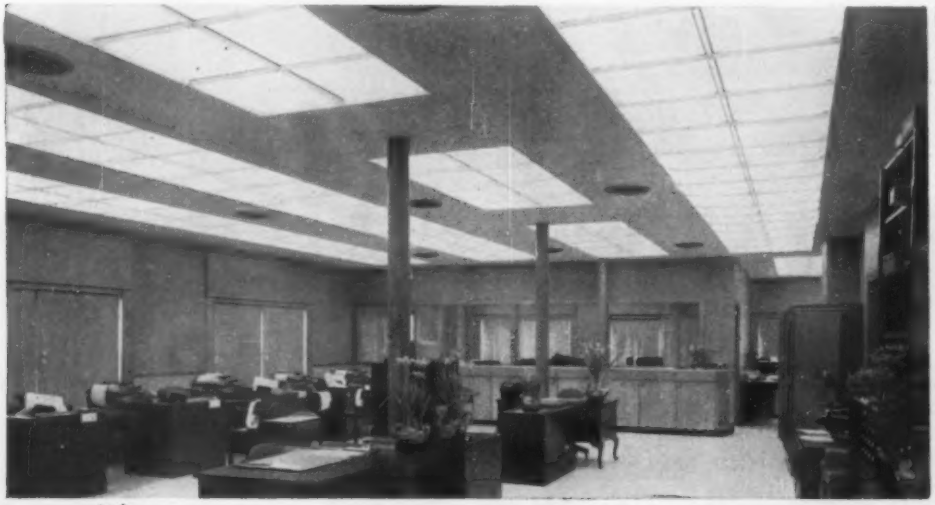
Choose from 3 *distinct and different* Area Lighting Systems . .

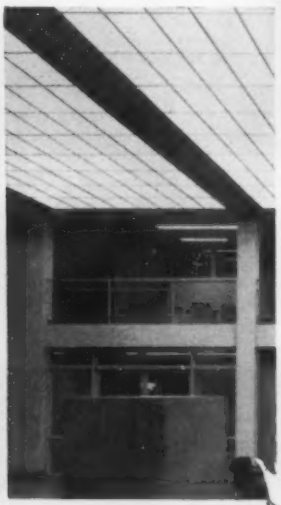
Before you bid your next area lighting job, take a closer look at the 3 systems now offered by Sylvania.

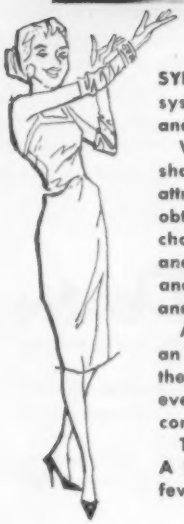
You'll find that all Sylvania systems are designed with the electrical contractor in mind . . . made to be installed with a minimum of time and effort.

The suspension elements of Sylvania's Area Lighting Systems are expertly engineered to reduce the number of parts as much as possible and to fit perfectly every time.

Except for the occasional use of a screwdriver or pliers, Sylvania's 3 systems go into place without tools. Even if you are unfamiliar with these systems you'll find that the multiple use of precision-made parts, simplicity of







SYLVA-LUME—This extremely versatile, modular system features an extruded aluminum grid work and offers unlimited flexibility and design freedom.

Vinyl plastic panels are provided in deep or shallow style—plain or patterned—in a choice of attractive colors. Single or double panels can be obtained. Optional acoustic baffles, also with a choice of colors, provide effective sound control and add another design element for delineation and emphasis. Perimeter panels give interesting and attractive border treatment.

All of these design factors can be utilized for an endless variety of ceiling patterns . . . allowing the addition of a distinctive personal touch to every installation from a relatively few catalogued components.

The standard Sylva-Lume module is 3' x 3'. A 2' x 2' module is also available with only a few limitations in variety.

SYLVA-CELL—This Sylvania modular system utilizes a 2' x 4' module and features a continuous pattern of cells. A choice of two attractive louvers is offered—polystyrene plastic or white painted aluminum, both with 45° x 45° shielding. Each ceiling offers excellent efficiency and shielding together with an even, widespread distribution of diffused illumination.

Sylva-Cell's simple, inverted-T grid work of extruded aluminum has extreme versatility for complete or partially-luminous ceilings. The louvered pattern can be used from wall to wall. Or, if desired, the interspersing of standard opaque ceiling materials makes a change in appearance, yet uses the same suspension system.

With Sylvania's minimum number of precision-made parts, installation is simple and fast. The open pattern of cells results in extremely minor problems of maintenance.

Go modern...with a Sylvania Lighting System!

. . . by SYLVANIA

attachments, and minimum on-the-job assembly results in fast installation the very first time.

And you'll take no unnecessary steps trying to level the system either. Sylvania's unique leveling devices assure accurate alignment without wasted motion and without tools.

Area Lighting is the best and the most complete form of illumination available today. It accounts for a larger portion of the building dollar than ordinary fixtures. It is the outstanding answer to the challenge of bringing better lighting to your customers.

This can mean more profit to you if you work with the right system . . . one of Sylvania's Area Lighting Systems.

Check into the numerous practical advantages of Sylva-Lume, Sylva-Cell and Sylvan-Aire. Then, on your next job, bid with confidence . . . bid Sylvania.

SYLVANIA LIGHTING PRODUCTS
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SYLVAN-AIRE—Sylvania's established area lighting system, featuring 3' wide rows of corrugated vinyl plastic, offers a most economical method of obtaining area illumination.

Sylvan-Aire offers two versatile suspension methods . . . Uni-Space and Vari-Space . . . making installation simple for any desired footcandle level. This system is easily adjusted for installation of air conditioning components, for spotlights, to fit around columns and other obstructions, or for partition planning.

Acoustic baffles are available, too, as optional equipment. When ordered, acoustic baffles are supplied pre-assembled to the support channels thus requiring no additional installation time.

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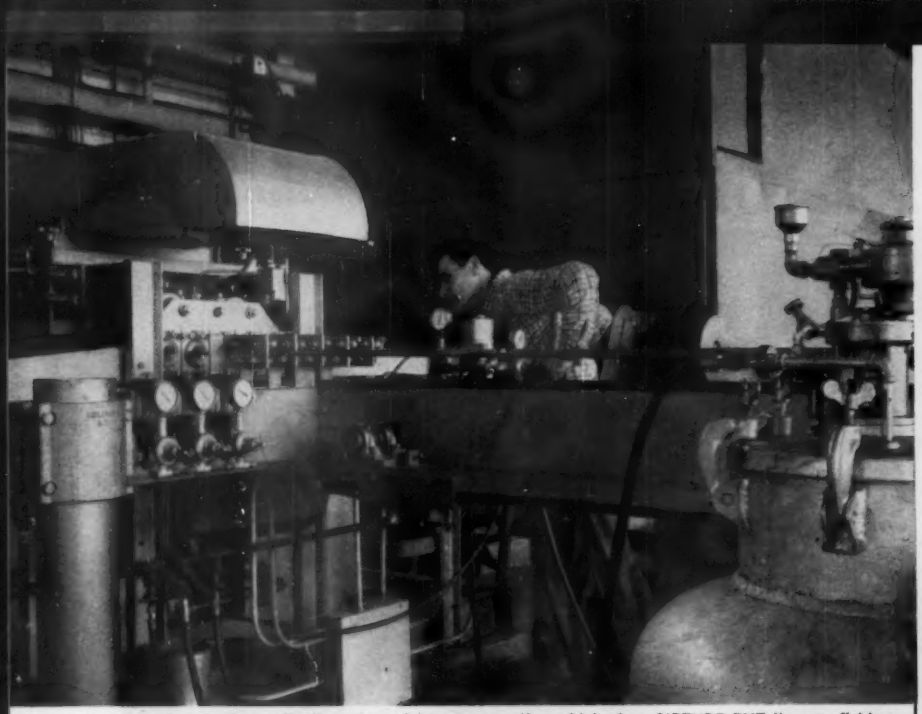

Here operator checks application of special lacquer coating which gives CIRTUBE EMT its easy fishing.

The fishing's easier, too with new CIRTUBE* EMT

PULLING wire through carelessly made, ordinary EMT often proves an annoying, time consuming business.

The answer isn't just a slick inside surface—what's needed also is a sort of built-in lubrication that helps conductors glide smoothly through long runs.

CIRTUBE EMT is made that way—with a baked-on protective inner coating containing wax-like ingredients in a special formula—always carefully applied to give the same easy fishing each time.

Here are other reasons why CIRTUBE EMT is always so easy to fish: clean, snag-free finishing is one; induction welding is another. This superior welding technique leaves no flash or bead to interfere with wire pulling.

Easy fishing is only one of many reasons why CIRTUBE EMT has won such quick acceptance. Give it a try next time you order—you'll like working with it. Now at your Circle wholesaler's. *Trade Mark

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a subsidiary of CERRO DE PASCO CORPORATION

PLANTS: Maspeth and Hicksville, N. Y. SALES OFFICES & WAREHOUSES: In all principal cities

RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
NEOPRENE SHEATHED CABLES • "CIRTUBE" EMT

CIRTUBE EMT *Ask for it!*

Proper steel plus! The best cold rolled steel plus the right handling give CIRTUBE EMT its natural bendability.

Split-free, bead-free! Induction welded CIRTUBE EMT, left, proves stronger than ordinary EMT, provides easier fishing.

Automated quality control! Automatic controls assure complete and continuing uniform quality of product.

Lifetime exterior finish! Hard galvanized finish for durability; polished satin lustre for lasting good looks.

Tight, easily handled bundles! Bright, orange tapes hold CIRTUBE EMT securely for easy handling on and off the job.

Fast, friendly service! Well-known Circle service through a nation-wide network of well stocked nearby warehouses.

News about

B.F.Goodrich Chemical *raw materials*

Sanford station of Florida Power & Light Company uses Geon conduit furnished by Hughes Supply of Daytona Beach. B.F.Goodrich Chemical Company supplies the Geon polyvinyl material only.

corrosion problem knocked out . . .

generating station gets conduit of Geon

YEARS from now pulling new cable through this conduit made from Geon polyvinyl materials will be just as easy as it is today. Unlike ordinary steel conduit, Geon conduit resists the corrosive effect of salt water, gases, chemicals and acid or alkaline soils. Internal and external surfaces stay smooth—like new.

Conduit or pipe made from Geon offers high tensile or impact strength. It stands up under pressure . . . is not subject to galvanic corrosion. It resists sunlight, fungi, bacteria, moisture, heat and cold. And its light weight makes installation especially easy.

Engineers are taking advantage of properties of pipe and conduit of Geon in a wide variety of applications. For information, write Dept. AU-3, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

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GEON polyvinyl materials • HYCAR American rubber and latex
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NO TARRING OR SPECIAL EXTERIOR PREPARATION NEEDED ON STEEL CONDUIT

this is one of the 10 reasons why

STEEL

CONDUIT IS BETTER

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3 Takes toughest punishments during construction
4 Uses standard tools and accessories
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6 Compatible with all building materials
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8 Greater protection of conductors after installation
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10 Proven for more than a half a century in millions of installations

CLAYTON MARK, pioneer in electrical conduit since 1910, specializes in producing steel conduit that meets all building specifications. Our facilities, engineering and production know-how guarantee quality products accepted as "The Contractors' Favorites" in the industry—Electrictube, Hotkote, Galvakote and Enamelkote.

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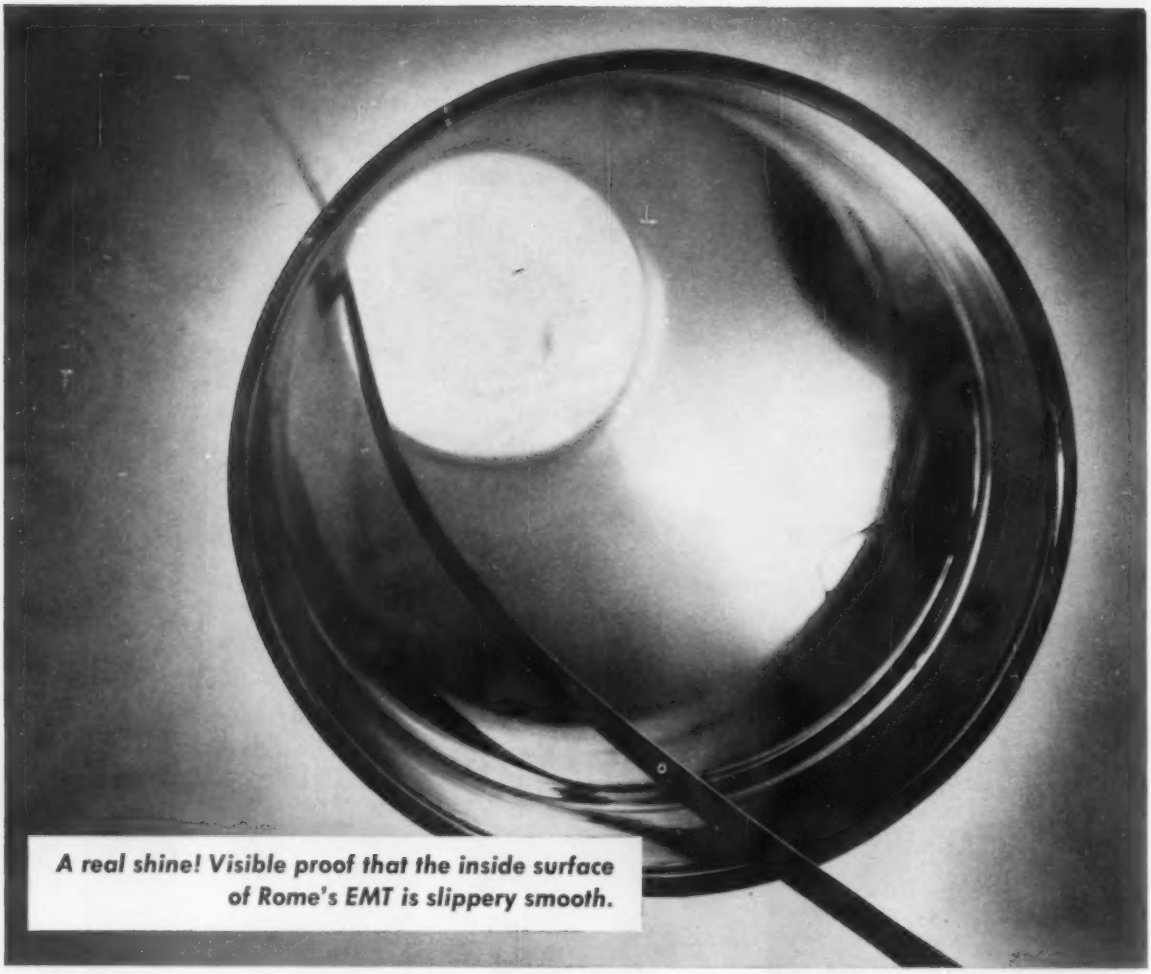

A real shine! Visible proof that the inside surface of Rome's EMT is slippery smooth.

"Tape's eye view" shows why Rome's EMT is easiest to fish

That shine you see is the reason fish tape won't "hang up" when you use Rome's EMT.

The slick interior finish of Rome's EMT lets your fish tape slide through with an absolute minimum of resistance. Careful baking—under rigid control—produces a uniformly smooth enamel-like finish inside Rome's EMT.

In a test conducted by the Anstice Company, a completely unbiased party, Rome's EMT came out first in fishability. Three ten-foot lengths of ½" EMT, Rome's and two competitive samples, were formed into identical figures containing eight bends. The ⅛" fish tape used in the test easily passed through the eight bends in Rome's EMT, but "hung up" on one of the bends in both competitive samples.

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Easy bending The strength of Rome's EMT interferes in no way with its ductility. You can make bends—even intricate ones—quickly and easily.

Corrosion resistance A uniformly electrogalvanized exterior finish protects your installation against corrosion. Long dependable service life is assured.

Use easy-fishing, easy-bending Rome EMT on your next job. Contact your nearest Rome Cable representative for more information—or write to Department 905, Rome Cable Corporation, Torrance, California.

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WAGNER TYPE DP MOTORS

PROTECTED against corrosion...

PROTECTED against splashing liquids...

WM59-9

Wagner Type DP Motors provide *double protection* that means longer life—more versatility of application. Rugged cast iron frames and endplates are highly resistant to corrosion. Dripproof enclosures are so well designed that these motors can handle many applications that formerly required splashproof motors. These motors pack ample power into little space, are light in weight and are easy to maintain.

SLEEVE BEARING MODELS AVAILABLE. The entire line of ratings is available with ball bearing construction, or with steel-backed, babbitt-lined sleeve bearings of high load carrying capacity that provide quieter operation.

Let a Wagner Sales Engineer show you how these motors can be applied to your needs. Call the nearest branch office or write for Wagner Bulletin MU-223.

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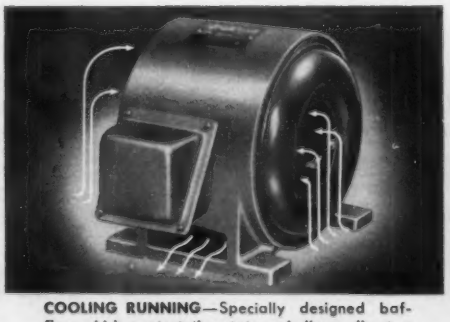
DOUBLY PROTECTED—Air intakes and outlets are positioned to provide complete protection against dripping or splashing liquids. Rugged cast iron frames protect against rough handling and corrosion.



COOLING RUNNING—Specially designed baffles, which protect the stator windings, direct a cooling stream of air through the motor to effectively cool the motor—add to motor life.

CAN BE RE-LUBRICATED—Original factory lubrication will last for years in normal service—but grease plugs are provided to permit re-lubrication that adds years to motor life under severe conditions.

Over 40 million readers will see the latest in contractor-installed devices in this spectacular 3-page ad, which Edison Electric Institute will sponsor as part of a big 30-page Medallion Home Section in the September 14th issue of LIFE magazine, out September 10th. Mass distribution of reprints by electrical utilities and manufacturers will reach MORE of your prospects, too.

A HOUSE-FULL OF NEW IDEAS TO HELP YOU
live better electrically with full HOUSEPOWER
HOUSE- FULL OF NEW ELECTRIC IDEAS
HOUSEPOWER

Cash in on the big, new

HOUSEPOWER "HOUSE-FULL OF PROFITS" PROGRAM

The largest ad in LIFE's history will feature newest contractor-installed devices to help you sell more, sell faster.

Yes, your prospects will be reading about the very newest devices available to help them live better . . . electrically.

Here's everything you need for your own "HOUSE-FULL OF PROFITS" program!

Campaign Guide to show you step-by-step ideas to follow in launching your own "HOUSE-FULL OF PROFITS" program. Write to National Wiring Bureau today for free copy.

Reprints of the 3-page HOUSEPOWER ad. Imprint space on back. $2 per 100; order from NELP, c/o Edison Electric Institute, 750 Third Ave., N.Y.C.

Sales pulling ad mats. Each ad urges prospects to call you for full HOUSEPOWER. Your name, address, and phone number can be added.

Your distributor's NEW HOUSEPOWER Idea Center will have promotion pieces . . . information on new, high-profit products to help you sell up.

AND continuing informative ads in *The Saturday Evening Post* and *Better Homes and Gardens* will also be selling your customers on the need for full HOUSEPOWER. So plan your own fall "HOUSE-FULL OF PROFITS" program now.

Check with your local electric utility or electric league now; check your distributor's HOUSEPOWER Idea Center for complete details on the new high-profit products which will make HOUSEPOWER jobs more profitable for you. And don't forget to write today for your free "HOUSE-FULL OF PROFITS" Campaign Guide.

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...until you figure on this underfloor duct! Here are four of the many reasons contractors have installed underfloor duct by Orangeburg in thousands of the nation's finest buildings: (1) It is light, easy to handle and to cut. (2) Its installed cost is exceptionally low. (3) Non-metallic, it lasts indefinitely. Corrosive action of cinder fill or concrete will not affect it. (4) It keeps a building "electrically modern" for its lifetime. New outlets can be tapped in easily and economically anywhere along duct line. Get the complete story before you figure your next job. Write Dept. EC-89 for Catalog 202.

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Underfloor Duct System

Count, sort, or inspect them faster

Self-contained relay

Low-cost; ideal for limit-switch-type application; includes a SP-DT output relay.

Transistorized relay

Features transistors; hermetically sealed plug-in relay; miniature light source, photocell holders.

General-purpose relay

A low-cost, highly reliable relay suited to counting, diverting, limiting and signalling jobs.

Explosion-proof relay

Watertight, explosion-proof; includes 3-inch lens, self-contained phototube, time delay.

Long-distance relay

Responsive *only* to light from accompanying light source; operates at distances up to 2,500 feet.

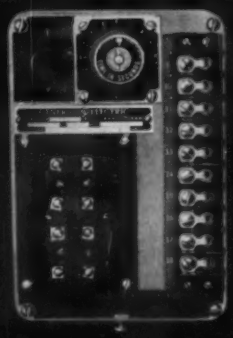
Smoke-density indicator

Measures smoke density, liquid turbidity, etc., and provides alarm when pre-set point is reached.

Voltage-sensitive relay

Detects voltage changes for meter operation, elevator-motor overspeed detection.

Electronic timer



Provides time delay of given duration, or set interval simply by setting dial at desired time.

Cut-off register control

Low-cost; features direct operation of solenoid, small scanner, timed reset and relay kits.

and more efficiently with modern

G-E electronic devices

Your General Electric distributor offers a full line of simple, easy-to-use controls

Whether you're automating a production line . . . replacing obsolete machines . . . or, trying to get more out of present equipment . . . one of General Electric's photoelectric or electronic controls may help you gain faster, more efficient production.

Why? Because G-E photoelectric and electronic control devices are specifically intended to take the complexity . . . the labor . . . and the waste out of modern-day production. Combinations of these devices are applicable to virtually any industrial counting, sorting, signalling, protecting, diverting, detecting, or limiting job. And, chances are they will do the job at less initial cost—and lower operating cost—than the control methods you are now using.

CONSIDER THESE EXTRA-VALUE FEATURES

Bonus features you get with job-proved General Electric photoelectric and electronic controls include:

Fast response—Relays operate on light changes as short as 1/1000th of a second.

Versatility—G-E relays operate on light increase, decrease, time delay, reflected light, slow or rapid light change.

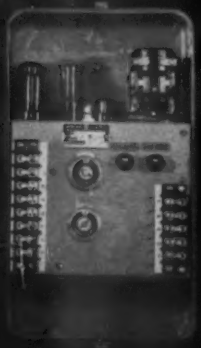
Dependability—Lamps operate 3,000 hours or more. Components are conservatively rated for long, maintenance-free life.

If you are not satisfied with the efficiency of your production operations, it will pay you to find out about G.E.'s complete line of control devices. Call your nearby G-E Apparatus Sales Engineer or Distributor. Or, send us the coupon below. *General Electric Co., Specialty Control Dept., Waynesboro, Va.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

High-speed relay

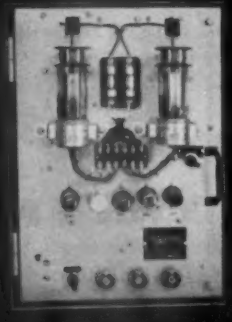


High-sensitivity; fast operating (600 ops. per min.); time delay, interlock, many other features.

Resistance-sensitive relay

Uses resistance changes to control a circuit; can operate motor to maintain liquid between two levels.

Side-register control



Accurately maintains lateral position of moving web in a process or machine; high-accuracy control.

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Schenectady 5, N.Y.

Please send me a copy of the new G-E Photoelectric Control catalog, GEA-6822, with description, specifications, and pricing data on the complete line.

Name _____

Company _____

Address _____

City _____ **State** _____

There are two main considerations in lighting a drive-in restaurant. 1) Providing enough light for safe movement and parking of a large volume of traffic; 2) Providing a well-lighted area that readily identifies the drive-in and attracts passing motorists. The above drive-in accomplished this by mounting 3 floodlights and 5 clusterlites on each of 6 poles. Mounting height 33 feet, pole spacing 24 feet.

Revere matched outdoor lighting equipment means fast, trouble-free installation

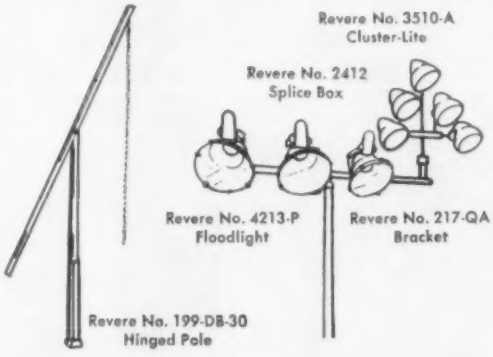
All components for the outdoor lighting installation shown above were made by Revere. All components—hinged poles, brackets, floodlights, cluster-lites and accessories—are made for each other.

By ordering your outdoor lighting from one reliable source, you can be sure that the equipment will fit together right when it gets to the job. This means fast, easy installation and less headaches for you.

You can also be sure that the components are structurally matched for strength and balance, and that they are matched in design for peak lighting efficiency and best appearance. All equipment from *one* source also means *one* delivery schedule from *one* manufacturer—all components reach the job at the same time.

Revere offers you the widest line of outdoor lighting equipment in the industry. No matter what the application, Revere has the equipment to do the job. Write for your copy of the Revere Catalog.

Revere components used in lighting drive-in restaurant



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OUTDOOR LIGHTING

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58TH YEAR • AUGUST 1959

ELECTRICAL CONSTRUCTION AND MAINTENANCE

Electric Heat— Apartments are a Prime Target

Use of electric space heat and domestic hot water in apartments and multi-family residential occupancies offer some decisive advantages to owner and tenant alike. Whether the project is a new building or a modernization, these advantages warrant alert consideration where house heating electric rates are favorable.

The substantially lower installed cost of a direct electric heat system compared with central wet heat is an immediate saving to the owners. The elimination of the central heating plant and its auxiliaries also results in more rentable space or revenue-producing tenant services.

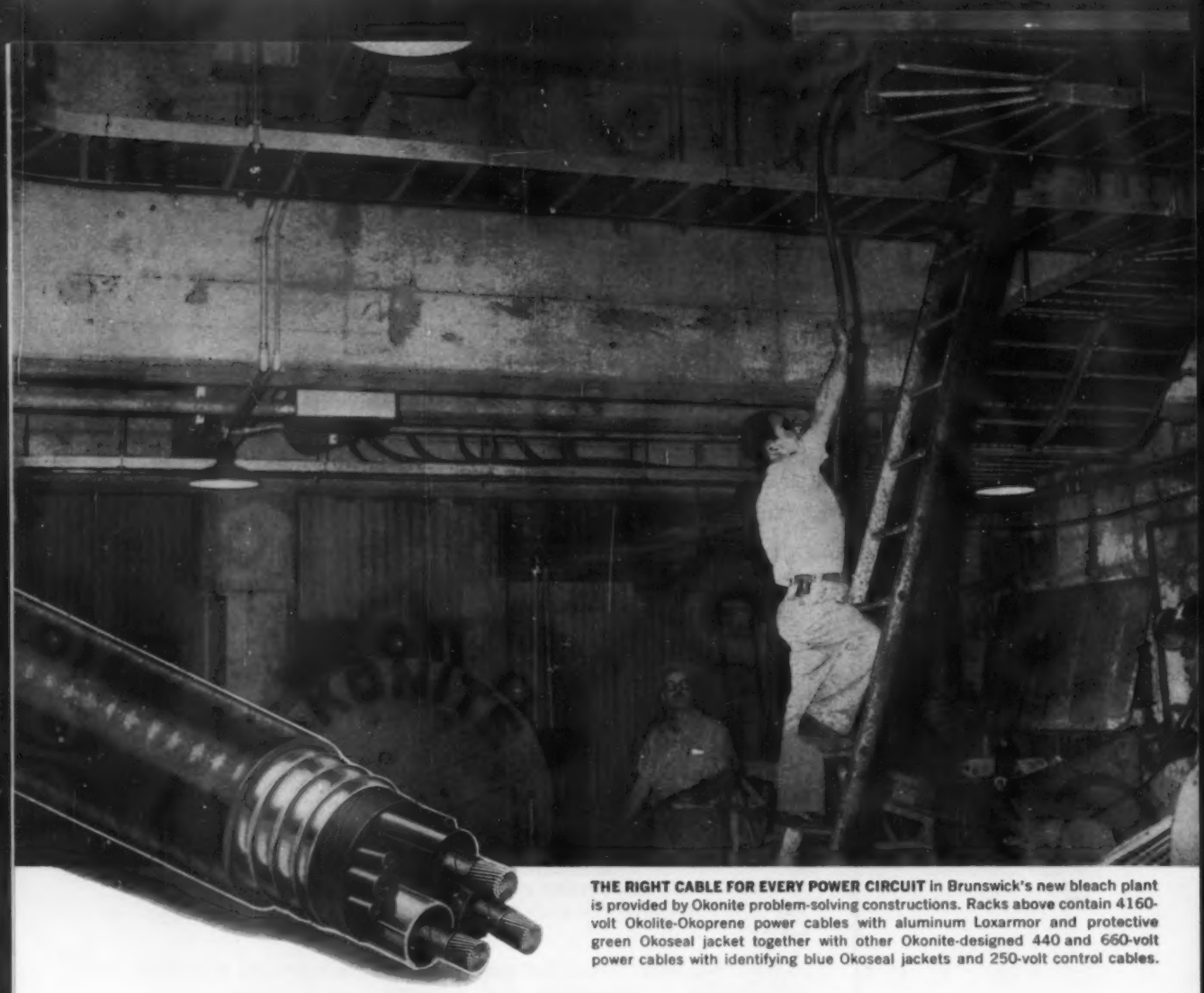
Equally important is the practical elimination of heating system operation and maintenance problems that electric heat affords. Tenant heat complaints, a chronic management headache, simply disappear. The tenant is in full command of his own environment. He can heat to his own precise preference without affecting his neighbor's comfort. And the system is inherently safe and maintenance free.

With individually metered apartments, the tenant also pays his own heating and hot water bills, a fair and equitable cost based entirely upon his own utilization. The owner, relieved of such operating costs, is in a position to offer more attractive living accommodations at relatively lower rentals.

Some precautions, however, are essential. The building must be insulated to the best electric heat specifications to minimize unnecessary heat losses and wasteful energy consumption. And some program of budget billing should be available to the tenant to spread his heating costs evenly over a number of months. Tenants accustomed to paying averaged heating costs absorbed in their monthly rentals are likely to be alarmed at high costs appearing in their December, January and February billings, even though such concentration is entirely normal for their annual heating requirements.

The question of comparable heating costs in tenant metered apartment installations becomes academic. No other heating system of comparable safety and luxury—and capable of individual tenant operation, control and metering—is practically available. Electric heat in apartment applications offers such clear benefits for owner and tenant alike that it should be a prime target for immediate industry sales development.

Wm. T. Stuart



THE RIGHT CABLE FOR EVERY POWER CIRCUIT in Brunswick's new bleach plant is provided by Okonite problem-solving constructions. Racks above contain 4160-volt Okolite-Okoprene power cables with aluminum Loxarmor and protective green Okoseal jacket together with other Okonite-designed 440 and 660-volt power cables with identifying blue Okoseal jackets and 250-volt control cables.

Okonite cable gives Brunswick Pulp & Paper maximum protection in chemical atmosphere—at lower costs

PROBLEM: For one of its vital electrical circuits, Brunswick Pulp and Paper Company's new bleach plant for modern, high-graded processes needed a primary distribution cable of 4160-volt capacity that could stand up to chemical attack. Mindful of the penalties of plant down time they sought maximum circuit security. They also wanted lower installation costs.

SOLUTION: They got both a superior cable and a less expensive installation by using Okolite-Okoprene 5kv cable with an aluminum Loxarmor covering and Okoseal jacket.

HERE'S WHY: *Okolite insulation*, applied by Okonite's exclusive strip process for maximum quality control, is moisture, ozone and heat resistant with lasting high dielectric strength. *Okoprene sheath* gives positive protection from moisture and most harmful acids, oils and chemicals. Lightweight *Aluminum Loxarmor*, for use in racks, eliminates the installation expense and the difficulty in changing a conduit system. *Okoseal* PVC (polyvinyl chloride) jacket was selected to counter specific chemical conditions in the plant. Colored green, it also identifies the primary circuit.

Okonite makes cables by all the known methods, has a background of 80 years of experience. You will get sound and unbiased recommendations when you call on your Okonite representative. In the meantime, ask for Bulletin EC-1117 on "How to Choose Insulated Cable."

THE OKONITE COMPANY
Subsidiary of Kennecott Copper Corporation
Passaic, New Jersey

where there's electrical power . . . there's **OKONITE CABLE**

6377

ELECTRICAL CONSTRUCTION AND MAINTENANCE

PROBLEMS IN

Estimating Electric Heating Costs

A discussion of methods in use, their shortcomings, and suggestions for further study.

By Glydewell Burdick, *Wisconsin Power and Light Co., Madison, Wis.*

THERE are good reasons today for making an accurate estimate of annual heating costs. (1) The prospective customer usually insists upon having a good idea of what his electric bill is likely to be. (2) If a loan is involved, the mortgagee or guarantor (FHA, for example) may demand a responsible answer before agreeing to the loan. (3) Carelessly made estimates which prove to be inaccurate result in customer dissatisfaction and injure electric heat's reputation.

The conscientious seller of electric heating will to the best of his ability make an estimate on the conservative, rather than the optimistic side. He prefers to run the risk of losing a sale rather than give a low estimate that will be difficult to reach in operation. When the actual cost is less than the estimate, the customer is happy; and there is no better way to get more customers than by having well satisfied customers.

Most heating cost estimates today make use of the degree-day method, as exemplified by the NEMA and FHA formulas. The NEMA formula is based on the design heat loss of the structure, the annual degree-days, and a factor which mathematically represents hours per day, with a theoretical value of 24. This number 24 is modified by the estimator to a correction factor with a value usually somewhere between 12 and 24 to wrap in one judgment package all the many other variables which reduce the actual consumption to a figure lower than that accounted for by the degree-days and design heat loss calculation. The FHA formula is quite similar.

In practice, some few jobs run unexpectedly higher than the estimate, and many run unexpectedly lower. There are many reasons; each of the factors in such a formula is suspect.

Estimating Electric Heating Costs

When electrically heated homes are as common as those heated by fuels, as they surely will be, the present attention to operating cost estimating will have become academic. However, current interest in annual heating costs by the prospective user of electric heat is stimulating research and refinements in estimating techniques not previously considered in the application of combustible fuels.

Thorough study of existing installations from many aspects over a period of time on an industry-wide basis will provide data from which accurate conclusions may be drawn to improve such estimates. It is necessary however that sufficient thought be given to the many factors involved so that the correct data may be accumulated and put to most profitable use.

This article analyzes the fundamentals of heat loss and energy consumption, with particular attention to the many variables which affect the accuracy of present estimating practices. — *EDITOR*

Design Heat Loss

Unit heat loss of structural materials is well documented. These "U values" assume, necessarily, a standard quality of construction, their accuracy depending to a great extent upon the quality of workmanship in each individual case. Too often the structure will con-

NEMA Formula For Estimating Electric Heating Energy

$$\text{kwhrs} = \frac{\text{heat loss (kw)} \times \text{degree-days} \times 18.5\ \text{hrs/day}^*}{\text{indoor design temperature} - \text{outdoor design temperature}}$$

*** The value 18.5 is commonly called the "C-factor"; values ranging from 12 to 24 are frequently employed in place of the 18.5 depending upon local conditions and experience.**

duct more heat than indicated by the standards due to careless assembly; conversely, meticulous workmanship will reduce the heat loss to a figure lower than that contemplated. The all-important quality of workmanship can be observed only during construction.

The factor in heat loss calculations most difficult to assess and most dependent upon careful workmanship is infiltration: the amount of cold air entering a structure through cracks and through the building materials themselves.

Although a method involving the measurement of total length of crack around doors, windows and other openings is often used to estimate infiltration, the prevalent practice is to use for infiltration heat loss the equivalent of heating from one-half to one air change per hour. In poorly insulated, fuel-heated structures, the loss represented by one air change per hour is usually less than 25% of the total heat loss. With normal occupancy in a very tight house constructed for electric heat, it is practical to get down to ½ air change per hour at the design condition. If the computation for such a structure is made at 1 change per hour, the calculated loss may prove to be 40% or more of the total heat loss, representing a 20 to 25% error on the high side.

On the other hand, if ½ air change per hr were used in the calculations, and the weatherproofing workmanship were mediocre, the actual air change could easily turn out to be 1 or more per hr and the calculation inadequate.

Standard U-factors for building materials assume a constant 15-mph wind, and wind cannot blow at 15-mph simultaneously on all exposed surfaces. Thus the conduction heat losses of those rooms which are on the lee side of the house are overstated, as is the heat loss of the total structure. However, since heating equipment must be sized for each room, the design condition must be assumed to exist for each room.

Ceiling cable jobs present a special problem in heat loss calculation. The temperature difference which should be used is not the difference between the indoor temperature control point (70F) and the outdoor temperature, but the difference between the temperature of the ceiling surface at design condition (probably 100F to 120F) and the outdoor temperature.

Floor calculations introduce another source of design error through the assumption of an arbitrary underfloor temperature which may be far different from the actual temperature at the design condition.

Annual Energy

Thus far we have been talking about considerations affecting *design* heat loss—that anticipated at the severest weather condition. It is not the *average* heat loss over the heating season, since average temperature difference is far less than at the design condition.

We use "degree-days" for computing the total heat loss over the heating season. The statistical degree-day figure as reported by official weather agencies is a valuable guide to but not an accurate index of seasonal heat loss. It is not based on an average of hourly temperature differences, but represents the difference between 65 F and the mean temperature when the latter is less than 65 F, the mean temperature being the average of the highest and lowest temperatures recorded for that day.

Our basic calculation is heat loss *per hour*, expressed either in Btu per hr or watts. (Watts may be better understood dimensionally if thought of as watt-hrs per hr, 1 watt being equal to 3.413 Btu per hr.) Therefore we multiply degree-days by 24 hrs to get degree-hrs of temperature difference.

For example, for a day with 65 degree-days, the *total gross heat loss* for a house with a design heat loss of 30,000 Btu/hr in an area with a −10 F outdoor design temperature would be

$$\frac{30{,}000\ \text{Btu/hr}}{80\ \text{deg TD}} \times (70 - 0) \times 24\ \text{hrs} = 630{,}000\ \text{Btu},$$

where 70 represents the indoor control temperature and 0 the mean outdoor temperature (65 F − 65 deg = 0 deg F).

Making the calculation for the same house directly from degree-days gives

$$\frac{30{,}000\ \text{Btu/hr}}{80\ \text{deg TD}} \times 65\ \text{deg-days} \times 24\ \text{hrs} = 585{,}000\ \text{Btu}.$$

Since degree-days are calculated using a base of 65 F rather than 70 F, which is the indoor control point, the degree-day formula already contains a correction factor amounting in this example to 45,000/630,000 or approximately 7%.

When the *net* heating requirement is figured from the NEMA formula, using a correction factor of 18.5, the result is

$$\frac{30{,}000\ \text{Btu/hr}}{80\ \text{deg TD}} \times 65\ \text{deg-days} \times 18.5 = 450{,}938\ \text{Btu}.$$

This means that, in this example, the NEMA formula contains a correction factor amounting to 179,062/630,000 or 28%. From practice and for different structures and climates, it is known that the actual correction factor will be found to be somewhere between 12 and 24. Using an *average* figure such as 18.5 is not very helpful, if the objective is to estimate the energy consumption for heating a specific house.

Thus we are using the C-factor to account for all miscellaneous heat gains resulting from occupancy and sun effects, and these heat gains are assumed to be a fixed proportion of the computed design heat loss. This simply is not true. For a well insulated tight house such heat gains make up a material part of the gross seasonal heating requirement, from 15% for large houses up to as much as 50% for the very small and highly insulated house.

Other serious errors involve heat loss through floors over unheated basements or crawl spaces and ceiling cable jobs. We compute floor heat loss with a TD of 30 to 35 degrees, add it to the other heat losses, and then put the much larger TD to outside air in the divisor. Then

we multiply by degree-days. Degree-days measure the seasonal temperature difference to outdoor air, and not the temperature difference to underfloor space.

A similar outright mathematical error creeps into ceiling cable calculations in assuming that the seasonal heat loss through the ceiling is the same as it is with in-space heaters such as electric baseboard. Degree-days do not measure the temperature difference between ceiling plaster and outdoor air, because ceiling plaster has to be warmer than 70 F to transmit heat into the rooms.

Conclusions

We are expecting too much accuracy from a simple formula in reflecting a group of variables, some too intangible to evaluate, and some so involved that the purpose to be served does not warrant the labor for evaluation. This does not mean that it is impractical to improve the accuracy of the NEMA formula. There are three opportunities to make the computation more objective and useful:

1. *Remove the largest known factor from the "correction factor" hodge-podge, by computing it separately.* That factor is the heat gain resulting from the miscellaneous use of electric energy in the home. This is such a large percentage of the annual heat requirement of a well weatherproofed home as to fully warrant direct recognition.

Usually the quantity of such energy can be determined rather closely for a given family. At the least, an estimate can be made from experience data for similar families. When so doing, we must also discard for the present the correction factor, by increasing it to 24. Later experience may show that it is safe to use it again, at a new value to reflect the composite effect of the remaining unmeasured variables and the correction factor inherent in the 65F base degree-days.

2. *Compute the annual energy loss of the floor separately from that for the rest of the structure,* directly recognizing the temperature which will obtain in the underfloor space during the heating season. If we are to have a reasonably accurate energy-use formula there appears to be no acceptable alternative. The calculation of the average temperature of that space is not simple. All too little experience data for electric heating and test data for crawl space temperatures and first floor heat losses are available, but a better estimate can be made.

3. *For ceiling cable jobs, compute the annual energy loss of the ceiling separately from that for the rest of the structure,* directly recognizing the temperatures of the ceiling plaster which will obtain during the heating season, and the temperature differences to the outside air. Those temperature differences, and not conventional degree-days, are the measure of the seasonal heat loss through such a ceiling and must be so recognized.

These three modifications of the NEMA formula are in use by the Wisconsin Power and Light Co. As yet there isn't enough experience data collected to prove their reliability; however they do appear to have a sound foundation in theory. The modified formula has been called the *Net Heating Energy* formula. The procedure followed is to compute the gross annual heating requirement (except floors and cable ceilings) as follows:

HEAT GAINS FROM OTHER SOURCES

Almost all of the heat in electricity used in the home (3.413 Btu per kwhr), except for water heating, goes to reduce the requirement which must be met by the heating equipment. When we are dealing with a thoroughly insulated and weatherproofed house, the heat so contributed is a major consideration and, for a very small house, may easily make up to 40 to 50% of the seasonal total requirement. Even water-heating energy leaves a material amount of heat inside, that being lost being the heat in the water when it leaves the house via the sewer.

A small part is also lost in the latent heat of vaporization of water, lost through the exfiltration of water vapor with air. Published data shows this to average about a pound an hour, say 1100 Btuh, for the average home, although this will vary widely for different homes. Some of this comes from body heat.

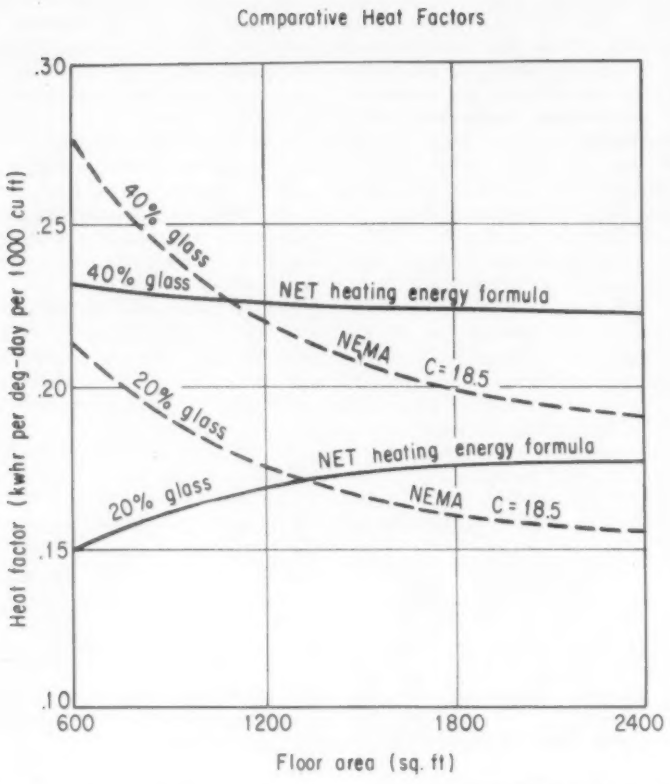
The heat gain from occupancy by an average of three people, at 400 Btuh per person, amounts to 28,800 Btu per day and 7.8 million Btu for a 9-month heating season, the equivalent of 2280 kwhr.

Solar radiation coming in windows contributes directly to heating the space. Depending on hours of sunshine, house construction, color, orientation and other factors, it also reduces heat loss through walls and roofs. Solar radiation on roofs raises attic temperatures materially above outside air temperature (modified by wind velocity and the attic ventilation afforded) and hence reduces heat loss through ceilings. The complexities of accurately assessing the effect of solar radiation are so extreme as to defy the attempt, at least for our purpose, but we do know that the sun contributes to the total heat required.

The habits of the occupants will have a great effect on the seasonal heat loss and energy consumption, and this also seems to defy estimate. The age and habits of occupants will have some effect on the number of times the doors are opened, and left open for varying periods. Some people may have windows open continuously. The room thermostat setting—and whether or not (and how much) it is set back—obviously will affect energy consumption, in an unpredictable amount.

For practical consideration, we may assume that heat gain from occupancy and the effect of solar radiation are more than sufficient to offset heat lost by exfiltration of water vapor, ventilation and hot water. This leaves a net gain due to lighting and electric appliances, which may be reasonably estimated.

The electrically heated home is almost always an all-electric home with an energy usage of 300 to 400 kwhr per month for water heating and of 400 to 600 kwhr per month for lights and other appliances exclusive of heating or air conditioning. Assuming that 50% of the water heating energy @ 300 kwhr per month goes to heat the house, this amounts to 1350 kwhr for nine months. Taking 100% of the other energy, @ 400 kwhr per month, raises the total another 3600 kwhr to a net gain of 4950 kwhr.



$$\frac{\text{Heat loss (kw)} \times \text{Deg-days} \times 24 \text{ hrs}}{\text{Design temperature difference}} = \text{gross kwhrs.}$$

Gross kwhr for the floor (and ceiling cable if any) are then added, to give total gross annual requirement. From this total an estimate of heat gain energy is deducted to arrive at the net heating energy requirement. No correction factor is used in place of the 24 hrs.

Example

Consider six well-insulated and tightly constructed homes of three different sizes (600, 1200 and 2400 sq ft) having in common the conditions listed with the accompanying curves and tabular data. To compute annual heating energy, we will apply the NEMA formula (with "C" equal to 24) to the heat loss, excluding that through the floor. We will then add the energy required to offset the floor loss and subtract the energy expected from the miscellaneous use of electricity (see accompanying discussion on "Heat Gains from other Sources").

This annual consumption may be related to the size of the house and the degree-days by a "heat factor" representing kwhrs per degree-day per 1000 cu ft of heated volume and obtained by dividing the total kwhrs by the product of the degree-days and volume expressed in 1000 cu ft.

From these tabulated results, it appears that choice of C-factor for use in the NEMA formula to produce the same results as the net heating energy method described should vary from 12.9 for the 600-sq-ft home to 21.1 for the 2400 with 20% glass, and from 15.4 to 21.6 with 40% glass.

The curves indicate that the two methods of computation would give comparable results only for homes with floor areas of approximately 2400 sq ft. For smaller homes, the NEMA formula with 18.5 C-factor appears to produce heat factors which are unrealistically high, resulting in high estimates. Applied to larger homes, however, the NEMA formula results in lower heat factors which will lead to low cost estimates.

Calculations for Six Sample Houses Heated by Electric Baseboard Units

	20% Glass			40% Glass		
	House Area (sq ft)			House Area (sq ft)		
	600	1200	2400	600	1200	2400
Design watts (excluding floor)	4524	7301	12888	5932	9309	16044
Gross energy, kwhr (excluding floor)	9197	14843	26201	12060	18925	32617
Floor energy, kwhr	904	1699	3220	904	1699	3220
Gross energy, kwhr (including floor)	10101	16542	29421	12964	20624	35837
Misc. energy supplied, kwhr (to be subtracted)	4950	4950	4950	4950	4950	4950
Net heating energy, kwhr	5151	11592	24471	8014	15674	30887
Indicated heat factor of above	.149	.168	.177	.232	.227	.223
Indicated NEMA C-factor to produce above results	12.9	17.7	21.1	15.4	19.0	21.6
Design watts, including floor	4757	7721	13664	6165	9729	16280
Net heating energy, NEMA formula with 18.5 C-factor	7412	12087	21488	9619	15234	26434
Heat factor, NEMA formula with 18.5 C-factor	.214	.175	.155	.278	.220	.191

Design Data

½ fresh air change per hour at design conditions

Net heat gain of 4950 kwhr for the heating season from miscellaneous use of energy in the home

Floor insulated with 6-in. mineral wool bats

Crawl space tightly constructed with uninsulated walls and slab; 17% of wall area exposed above ground

Annual degree-days: 7200

Outdoor design temperature: —15F

Basal ground temperature: 50F

Heat loss factors (Btu/hr/sq ft/deg TD):
Ceiling: 0.04
Wall: 0.06
Floor: 0.039

PARKING AREA at Mayfair Shopping Center, Wauwatosa, Wisconsin, is uniformly lighted by mercury vapor floodlights, pole mounted. At top of each 60-ft pole is a circle of 16 Alzak reflector floodlights, each equipped with a 400-watt color corrected mercury lamp. Note clean, uncluttered appearance provided by high mounting of units.

At Mayfair—

Mercury Floodlights Aid Parking

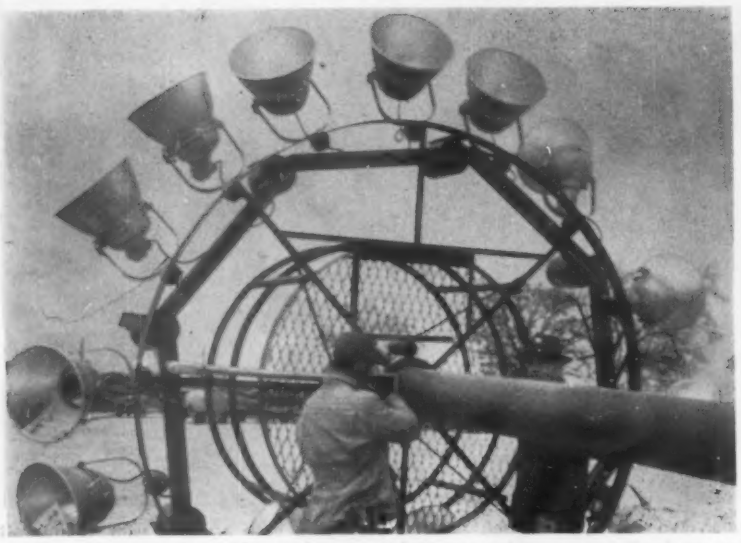
Milwaukee's huge Mayfair Shopping Center uses 768 400-watt color improved mercury vapor lamps in open-type Alzak aluminum floodlights to light its 44-acre parking area to average lighting level of two footcandles.

By John S. Haney, Illumination Sales Manager
Crouse-Hinds Company, Syracuse, N. Y.

THE mercury vapor floodlight, previously the long shot when matched in any competitive sweepstakes against the incandescent luminaire, has shaken off its former drawback—unflattering color characteristics—to become a frontrunner in floodlighting, offering its users economy, efficiency, and easy maintenance. No stronger brief can be made for this type of luminaire than to cite its use to illuminate the parking area at Mayfair—giant new regional shopping center at Milwaukee, Wis.

Mayfair's 44-acre parking area uses 768 mercury vapor floodlights (Crouse-Hinds type MVF) mounted 57 ft high in clusters of 16 units each atop 48 steel poles. Spaced 220 ft by 250 ft, the poles form two great squares, one inside the other, which completely enclose the Center's commercial structures. Each pole covers 48,400 sq ft and each floodlight 3,025 square feet. The system produces an average lighting level of 2 footcandles.

System's burning hours are controlled by an IBM control center and are set seasonally. Average burning time throughout the year is five hours a night. Using a clock system, the lighting cycle ranges from twilight lighting through full capacity operation and ends by providing only protective lighting for the remaining night hours (four floodlights out of every 16, which



FLOODLIGHTS were installed on 9-ft diameter steel ring and entire assembly attached to poles before raising. Pole top assembly also includes platform of 3.14 lb. walk wire, with hinged access door in floor of platform and two circular guard rings. Transformers are 2-lamp type, mounted on a hexagonal wireway installed inside the 9-ft diameter mounting ring for the floodlights.

are aimed toward the buildings, burn continuously throughout the entire cycle).

Why a Mercury Vapor Floodlighting System?

In planning the parking area lighting, the owners of Mayfair, Froedtert-Mayfair, Inc., had the following goals in mind: that the parking area lighting installation must provide evenly distributed light, that installation and maintenance costs be minimized and yet, upon completion, that the installation should present an attractive—almost dramatic—appearance.

Consequently, both street lighting and floodlighting systems were compared, and the respective merits of mercury vapor and incandescent fixtures evaluated. Here are the principal reasons that lead to the selection of a mercury vapor floodlighting system at Mayfair.

General Appearance. The owners wished to avoid the "forest of poles" effect of street lighting. Floodlighting permitted the use of taller poles, fewer in number, and a more attractive appearance; also could be ornamented to dress up the Center's approaches, or serve as signs. They add pleasing vertical lines to the Center, dramatically complementing the flat planes of its building facades.

Economy. Operational costs for floodlighting are less, thereby allowing accrued savings to be passed to tenants; because of fewer pole locations, trenching and footing costs are lower. Maintenance is also simpler for floodlighting. At Mayfair, one man, using a portable electric elevator supplied by the pole manufacturer (Tulito), accomplishes all relamping. By attaching the elevator to a steel cable at each pole, the operator can raise himself effortlessly to the top of the pole.

Efficiency. Floodlighting's fewer number of poles allows more parking space and, in turn, less obstruction for both parking and moving cars. Street lighting's lower mounting heights place light sources too low, causing them to detract from store name signs and other lighting. Moreover, the high lumen-per-watts ratio of mercury vapor floodlights cuts down the need for a large number of incandescent luminaires. If incandescent units had been used at Mayfair, twice as many units would have had to be mounted and aimed. Finally, the distorted color effects which mercury vapor floodlights formerly produced on certain colors and the human complexion have been eliminated by using the new color improved lamps.

BASE for floodlight poles consists of 5-ft deep concrete footing, in which are moored four anchor bolts. Concrete is held firmly by compacted soil.

Details of the Floodlighting System

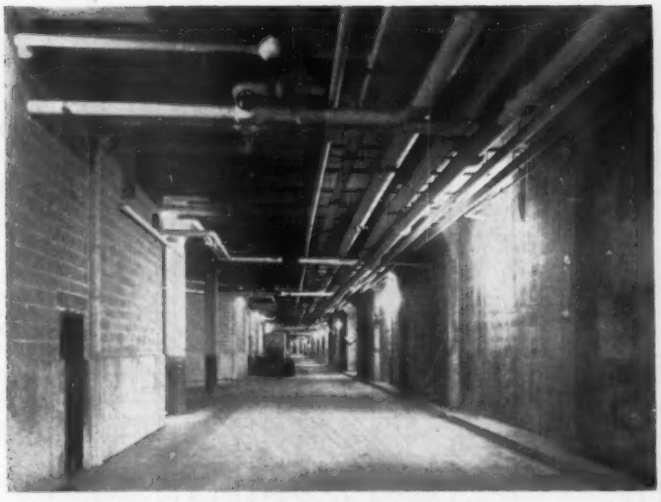
The entire area, including both parking space and buildings, was divided into quarters with each quadrant containing 12 poles. Poles 1 through 5 are nearest to the buildings, while poles 6 through 12 cover the outside parking areas.

All poles are 60 ft high with a 16-luminaire head platform or basket set at 57 ft. A pole basket is held in place by six iron stringers. Access to the floodlights is provided by a hinged access door. An 8-ft long mast stands atop each pole, supporting a pennant and 5-in. round gold leaf copper ball.

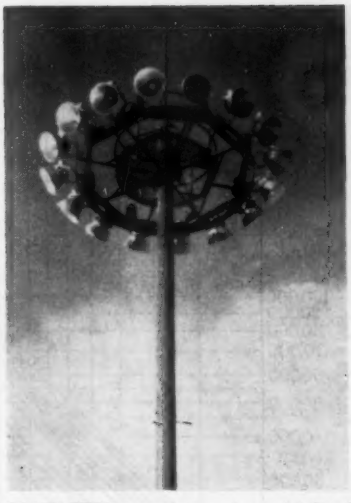
All floodlights use J-H1 color improved, 7,000 hour mercury vapor lamps and Alzak reflectors. The floodlights have cast aluminum rear relamping doors and heat tempered impact resisting lenses which are spun-sealed into the reflectors. The lamps have a fluorescent phosphor on the inside of the outer bulb.

Sixteen floodlights were bolted to a 9-ft steel ring that surrounds each pole basket and were aimed to provide uniform illumination over the area covered. All adjustments were made from pre-calculated horizontal and vertical degree settings.

Mayfair Shopping Center occupies a 105-acre tract, located alongside Highway 100 at Wauwatosa, Wis., and was built to serve Milwaukee and its expanding suburbs as well as large sections of eight neighboring counties. The project itself covers 60 acres, on which stand nine buildings, comprising a million square feet of building space and grouped to form



UNDERGROUND PASSAGEWAYS are lighted with 400-watt mercury lamps installed in wall-mounted units, equipped with heat-resisting deflecting spread lenses. A total of 50 of these units, Crouse-Hinds Type RCD-12, were used. Generally, such areas are lighted with incandescent or fluorescent reflector type units, installed overhead. In this case, however, wall-mounted units were selected to eliminate the problem of mounting the units in the maze of pipes overhead, and to obtain the higher efficiency, long life, and excellent color quality of the color-improved mercury vapor lamps. The high quality of the lighting obtained, with its excellent diffusion and uniform coverage, also contributes to safety in the handling of trucks in the area.



COMPLETED installation shows 16-floodlight cluster at top of 60-ft pole, surmounted by 8-ft long pennant pole. Each floodlight was individually adjusted by setting to pre-calculated horizontal and vertical degree settings. Each floodlight covers 3,025 sq ft of parking area, and each pole covers 48,400 sq ft. Units are accessible for cleaning and relamping by means of elevator provided for this use.

two malls and a central plaza. Marshall Field and Gimbels are principal tenants—each has a large department store at the ends of the area. Remaining buildings house 80 to 90 shops, a five-story office building, and a medical center.

Because of its size, function and general layout, Mayfair appears similar to Detroit's Northland Shopping Center. It is 10% larger than Northland, which serves 550,000 people. Its malls, plaza, and walkways give the shopper the same feeling as that of walking about a series of up-to-date village commons. The well-equipped building interiors create an atmosphere of relaxed, comfortable efficiency. The building exteriors are finished in hard, burnt brick which, being tan, minimizes their massiveness yet sets them off against the Center's greenery and other decorative trim.

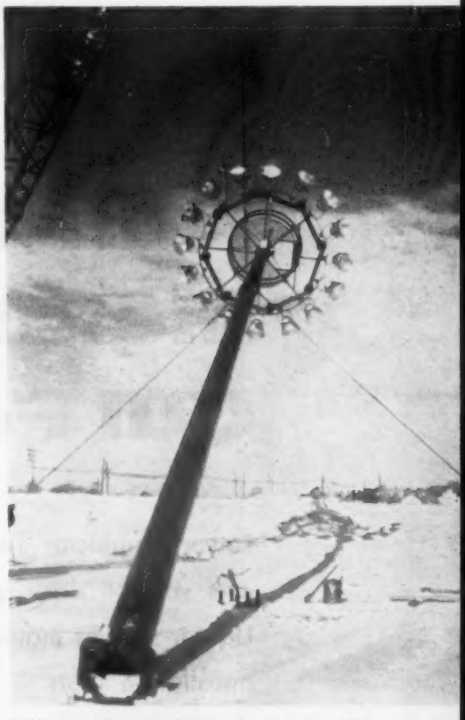
Electrical Service

Power is fed to the floodlights through two primary service lines from the local electrical utility company. Parking area has four substations, one located at each corner. Each feeds a 480/277-volt 3-phase 4-wire network to the lamp ballast transformers on each pole. These provide 5.0 amps starting current and 3.2 amps operating current for each lamp.

Underground Lighting

Mercury vapor lighting is used underground, too, at Mayfair. The underground delivery passageways are illuminated by 50 special purpose wall mounted lighting fixtures (Crouse-Hinds RCD-12), equipped with 400-watt color corrected mercury vapor lamps. The passage is loop-shaped, enabling truck to enter, load or unload, and exit from the same entrance. A traffic island located in the center of the entrance divides traffic into three lanes—one to enter, one to leave, and one for traffic making another swing around the passageway. A traffic signal prevents entering traffic from colliding with traffic about to make another trip through the underground roadway.

Parking lot floodlighting at Mayfair was planned by two architectural firms, Grassold & Johnson & Associates, Milwaukee, and Perkins & Will, Chicago; Construction Engineer was Phil Akwa; electrical engineering, Arthur Wanty & Associates, Elm Grove, Wis.; and electrical contractors for the parking area lighting only, National Electrical Company, Milwaukee.



ENTIRE POLE and completed assembly was crane-hoisted into position over concrete base. Hand-hole and cover 17 ins. from bottom of pole permitted final electrical connections.

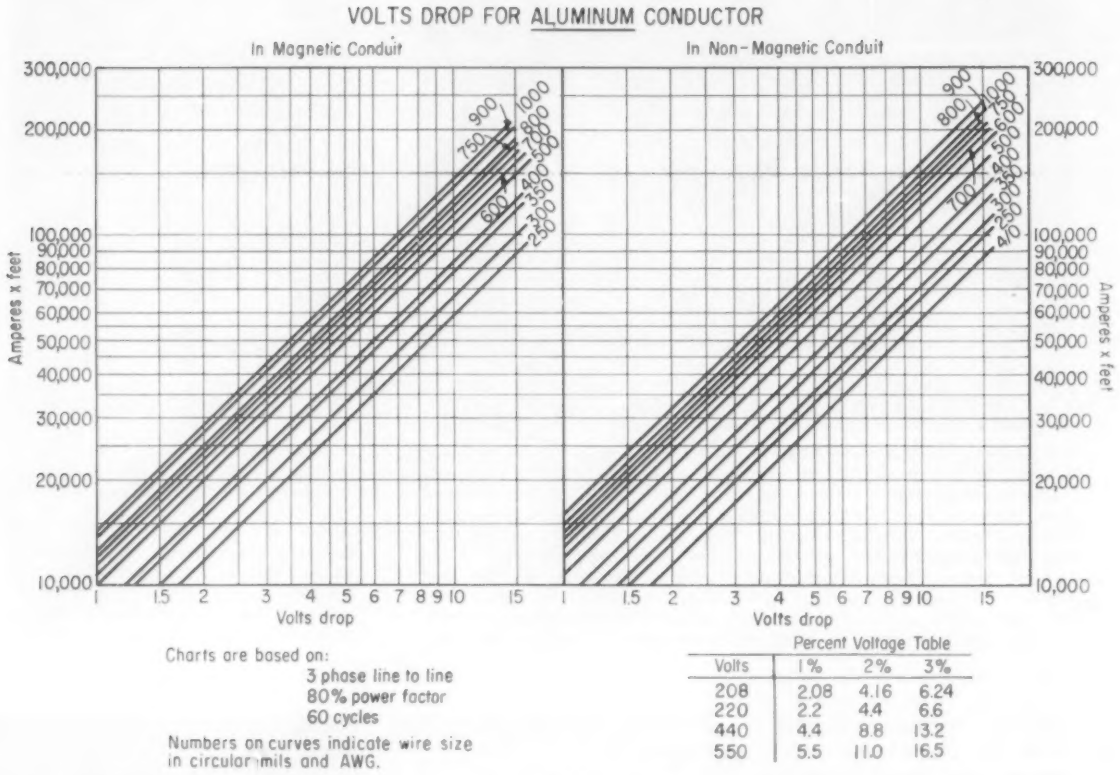

VOLTS DROP FOR ALUMINUM CONDUCTOR
In Magnetic Conduit
In Non-Magnetic Conduit
Amperes x feet
Volts drop
Charts are based on:
3 phase line to line
80% power factor
60 cycles
Numbers on curves indicate wire size in circular mils and AWG.
Percent Voltage Table
Volts | 1% | 2% | 3%
208 | 2.08 | 4.16 | 6.24
220 | 2.2 | 4.4 | 6.6
440 | 4.4 | 8.8 | 13.2
550 | 5.5 | 11.0 | 16.5

FIG. 1—VOLTS DROP CHARTS for aluminum conductor in magnetic and non-magnetic conduit.

Non-Magnetic Metal Raceways Cut Feeder Costs

Lower conductor reactance in non-magnetic aluminum conduit cuts voltage drop, permits use of smaller cables and conduits. Lighter weight material and easier handling add up to reduced installation costs.

By Elden G. Fox, *Senior Electrical Engineer*
Electrical Conductor Division, Kaiser Aluminum & Chemical Corp., Newark, Ohio

VOLTAGE drop is a prime consideration in the design of any efficient electrical system. Less than rated voltage at an outlet may lead to overheated or damaged motors, lower operating speeds, less light, and higher power costs. Selected circuit conductors must have sufficient ampere capacity (hence size) to take care of the known electrical loads, future additions and the inherent conductor voltage drop. Anything that can reduce this drop will have an effect on the installation and operating economics of the designed system.

Conductor reactance (inductive) in an alternating current circuit contributes significantly to voltage drop when conductor sizes No. 2/0 and larger are involved. In magnetic enclosures (conduits, raceways) conductors have a higher reactance than in non-magnetic conduits. One way to reduce this reactance component, and hence overall voltage drop, is to place the conductors in non-magnetic raceways. Frequently, this approach permits use of smaller size conductors (Figs. 1 and 2) with a resultant reduction in conduit size.

Design Advantages

The first place to consider reduction of voltage drop is in the design stage of a new or rehabilitated electrical system. Once a conductor size has been selected to carry the known and anticipated load current (based on National and local Codes), the next step is to carefully check circuit voltage drop. From calculation or charts, it can be determined if the selected conductor size will be adequate to handle the load and maintain voltage drop within prescribed limits. At this point, consideration of non-magnetic raceways can become a significant factor in design economics.

To illustrate, let's follow the investigative approach of a design engineer laying out and specifying the electrical feeders for a 120/208-volt, 3-phase, 4-wire distribution system (Fig. 3) for a 10-story laboratory building. He already has decided to use aluminum RHW insulated conductors. The point in question: should riser conduits be magnetic (steel) or non-magnetic (aluminum)? The answer is found in Figs. 1 and 2 which plot ampere-feet vs. volts drop for larger size

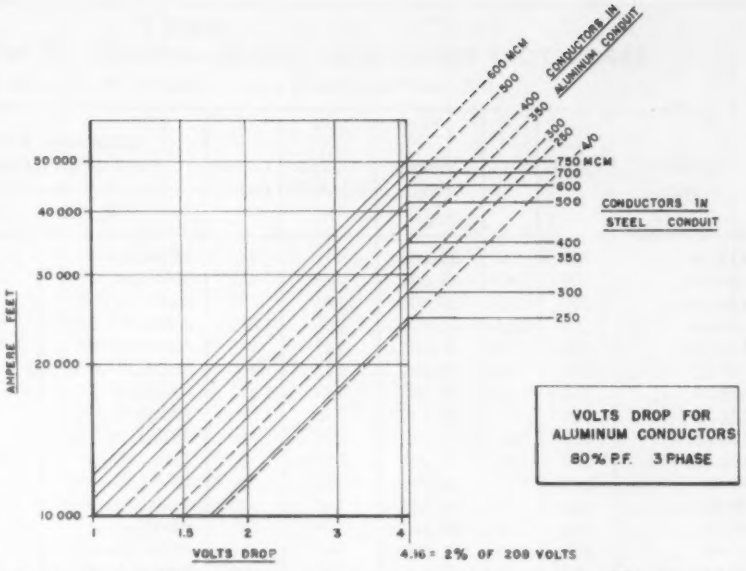
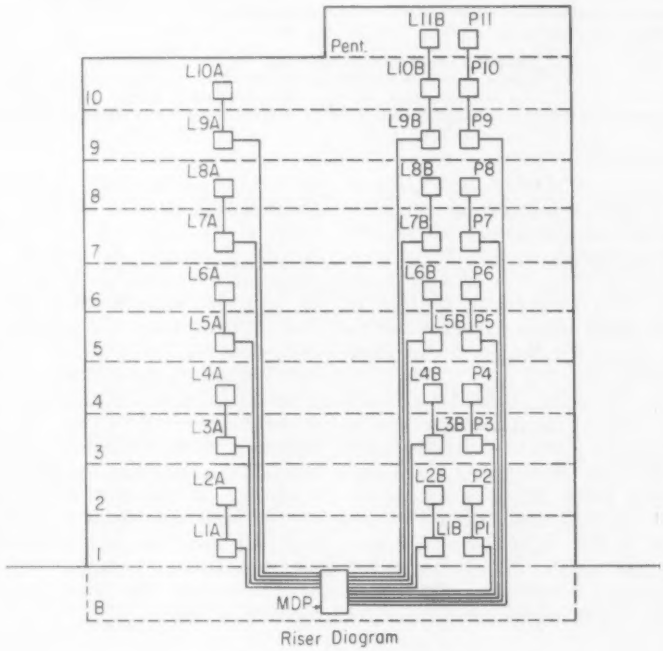
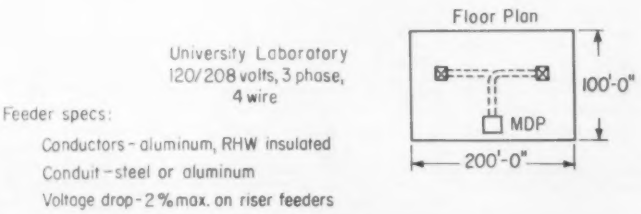


FIG. 2—CABLE SELECTION chart for aluminum conductor based on 2% volts drop. Start at calculated ampere-feet point (left); go horizontally to volts-drop line; read correct conductor size for magnetic conduit (right) or non-magnetic conduit (upper).





University Laboratory
120/208 volts, 3 phase,
4 wire

Feeder specs:

Conductors - aluminum, RHW insulated

Conduit - steel or aluminum

Voltage drop - 2% max. on riser feeders

FIG. 3—RISER DIAGRAM for 10-story laboratory building used in feeder comparison study.

TABLE I
LABORATORY FEEDER COMPARISON—MAGNETIC VS NON-MAGNETIC CONDUIT
(120/208 Volts, 3 Phase, 4 Wire Feeders at 2% Allowable Voltage Drop)

CIRCUIT NO.	AMPS.	FEET	AMPERE-FEET	TOTAL CONDUIT	TOTAL CABLE	ALUMINUM CABLE PLUS STEEL CONDUIT		ALUMINUM CABLE PLUS ALUMINUM CONDUIT	
						SIZE	COST*	SIZE	COST*
L1A-2A	200	115	23,000	115	480	250MCM—3″	$263.27	4/OAWG—3″	$253.04
L3A-4A	200	145	29,000	145	610	300MCM—3″	378.86	250MCM—3″	336.55
L5A-6A	200	175	35,000	175	730	400MCM-3½″	631.89	350MCM—3½″	592.64
L7A-8A	200	205	41,000	205	860	500MCM—3½″	793.21	500MCM—3½″	698.54
L9A-10A	200	235	47,000	235	980	700MCM—5″	1,365.88	600MCM—4″	1,049.33
L1B-2B	200	115	23,000	115	480	250MCM—3″	263.27	4/OAWG—3″	253 04
L3B-4B	200	145	29,000	145	610	300MCM—3″	378.86	250MCM—3″	336.55
L5B-6B	200	175	35,000	175	730	400MCM—3½″	631.89	350MCM—3½″	592.64
L7B-8B	200	205	41,000	205	860	500MCM—3½″	793.21	500MCM—3½″	698.54
L9B-10B-11B	200	235	47,000	235	980	700MCM—5″	1,365.88	600MCM—4″	1,049.33
P1-P2	250	115	28,800	115	480	350MCM—3½″	386.57	300MCM—3″	302.00
P3-P4	250	145	36,200	145	610	400MCM—3½″	525.95	350MCM—3½″	493.12
P5-P6	250	175	43,700	175	730	600MCM—4″	776.17	500MCM—3½″	679.51
P7-P8	200	205	41,000	205	860	500MCM—3½″	793.21	500MCM—3½″	798.54
P9-P10-P11	200	235	47,000	235	980	700MCM—5″	1,365 88	600MCM—4″	1,049.33
						Total Cost of Aluminum Cable with Steel Conduit	**$10,714 00**	**Total Cost of Aluminum Cable with Aluminum Conduit**	**$9,182 70**

Savings using non-magnetic Aluminum Conduit $1,531.30 or 14%

NOTES: *List Prices Used

Estimated savings show advantage of using non-magnetic conduit where voltage drop is prime consideration in final selection of feeder sizes. In many cases, reduction in conduit and cable sizes resulted.

Comparison based on total costs of cable and conduit only. No fitting costs or installation labor were included.

aluminum conductors in both magnetic and non-magnetic conduits. Figure 2 is a composite of the two sets of curves in Fig. 1; gives a quick one-step indication if magnetic or non-magnetic conduit is more advantageous from a design standpoint for the conductor sizes involved.

For example: Consider Circuit L9A-10A (Fig. 3) which has a 200-ampere load and a circuit length of 235 feet. Multiplying these two factors gives 47,000 ampere-feet. Place a ruler horizontally across the chart in Fig. 2 at the 47,000 ampere-feet mark. It intersects the vertical 4.16 volts drop (2%) line at the 700MCM conductor curve indicating the conductor size required for magnetic conduit. However, the same chart indicates that a 600-MCM aluminum conductor will maintain the same 2% voltage drop up to 50,000 ampere feet when enclosed in non-magnetic conduit. In fact, close study of this chart shows that aluminum conductors ranging from 300MCM to 750MCM can generally be reduced in size and still maintain prescribed voltage-drop limits when enclosed in aluminum conduits. While the curves are plotted for aluminum conductors, a duplicate chart for copper conductors would reveal a similar voltage-drop advantage when non-magnetic conduit is involved.

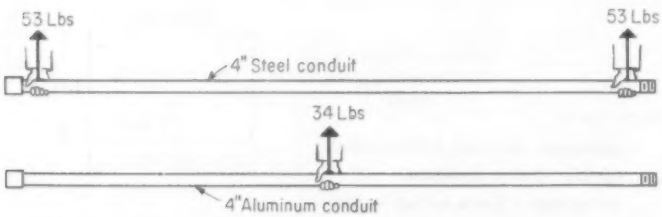


FIG. 4—LIGHT WEIGHT of aluminum conduit makes it easier to handle and support, particularly the larger sizes and in overhead installations.

Conductor size reduction is not the only design advantage. In many cases, a reduction in conduit size follows within the limits established by Table 4 of the National Electrical Code. Typical conduit reductions are indicated below:

AWG Wire Size Reduction — MCM

350 — 300
600 — 500
700 — 600

Conduit Size Reduction

3 Conductors	4 Conductors
3″ —2½″	3½″ —3″
3½″ — 3″	4″ — 3½″
	5″ — 4″

Fifteen feeders serve a total of 32 distribution panels in the hypothetical 10-story university laboratory building shown in Fig. 3. By using non-magnetic (aluminum) conduits for these feeders, conductor sizes in 13 of them could be reduced. In 5 of the 13, reduction of conductor size led to a reduction in conduit size. The resultant economy in conduit and cable can be attributed to the lower voltage drop factor when non-magnetic raceways are employed. Comparative data on

this group of feeders (for both magnetic and non-magnetic riser conduits) are shown in Table I.

Combined with the economical design factors noted above are additional advantages inherent with light weight aluminum raceways. Weight has a direct bearing on conduit installation costs. It obviously takes more men and more man-hours to handle and install heavy materials than lighter items. Worker fatigue and the number of required hangers or supports also vary with weight. This is particularly significant for larger size conduits and overhead installations.

To illustrate what can happen to estimated conduit installation man-hours on a specific project, consider the comparison feeder study of the 10-story building in Fig. 3. The figures in Table II show the total footage, weight and installation man-hours for riser conduits involved in the two design approaches.

It is interesting to note that the reduced cable sizes permitted by non-magnetic aluminum conduit (lower voltage drop) have eliminated the need for 5-in. conduit.

While the total footage of riser conduit is the same in both designs, the aluminum system shows a substantial advantage in weight and man-hours. Total weight of aluminum conduit involved in the design is only about 27% of the weight of steel that would be required. This is reflected in an estimated saving of some 411 man-hours (56% of the total labor units for steel) for the riser conduit installation alone.

The laboratory building comparison study was developed to show the economics of an aluminum feeder distribution system in a specific installation. The same general technique can be applied to investigate the design and installation economics of any electrical feeder. Charts in Figs. 1 and 2 can be used to check the voltage drop factor and the possibility of reducing conductor sizes when non-magnetic raceways are used. When copper conductors are involved, voltage drop charts or tables for copper should be used.

For the benefit of those planning to investigate the economics and feasibility of using non-magnetic raceways, Table III presents unit weights and installation man-hours for the more common sizes of steel and aluminum conduit as indicated graphically in Fig. 5. These were the basic units used in developing data in Table II.

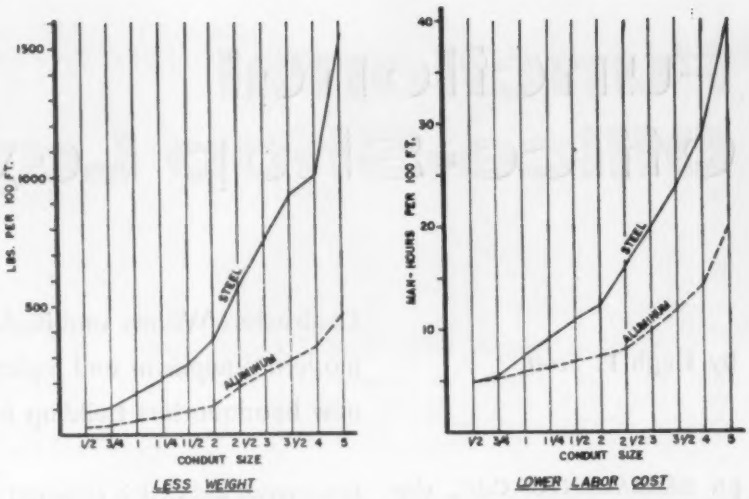


FIG. 5—CONDUIT WEIGHT has a direct bearing on installation cost. Man-hour curves for aluminum and steel closely follow weight relationship.

TABLE II—MAN HOUR COMPARISON—LABORATORY FEEDERS

STEEL CONDUIT				ALUMINUM CONDUIT			
Size	Feet	Weight—lbs.	Man Hours	Size	Feet	Weight—Lbs.	Man Hours
3"	520	3,993	104	3"	635	1,524	63
3½"	1,225	11,490	294	3½"	1,285	3,700	154
4"	175	1,862	50	4"	705	2,397	102
5"	705	10,927	282				
Totals	2,625	28,272	730		2,625	7,621	319

NOTES:
Weight comparison shows 7,621 pounds of aluminum conduit vs. 28,272 pounds of steel conduit.
Savings of 411 installation man-hours means a labor cost reduction of some $1,500 to $2,000.

TABLE III—CONDUIT COMPARISON WEIGHTS, LABOR UNITS, MATERIAL COSTS

(Per 100 Feet)

	STEEL CONDUIT			ALUMINUM CONDUIT		
Conduit	Weight	Man-Hours	Average Cost To Contractor $/100'	Weight	Man-Hours	Average Cost To Contractor $/100'
½	82.6	5.0	16.25	27.4	5.0	16.49
¾	108.6	5.8	21.14	36.4	5.2	21.46
1	164.4	7.5	30.30	53.0	6.0	30.78
1¼	219.3	9.2	39.56	69.6	6.4	40.21
1½	276.6	11.0	47.08	86.2	6.6	47.91
2	370.0	12.3	62.88	116.0	7.4	64.00
2½	580.0	16.2	97.49	183.0	8.1	99.30
3	768.0	20.0	127.51	240.0	10.0	129.88
3½	938.0	24.0	167.11	288.0	12.0	169.71
4	1,064.0	29.0	197.83	340.0	14.5	200.90
5	1,550.0	40.0	313.91	465.0	20.0	317.33

NOTES: Steel conduit manhours are average of several contractors' experience and published estimating data.
Aluminum conduit manhours, based on weight comparison and handling experience, are following percentages of steel units: ½"—100%; ¾"—90%; 1"—80%; 1¼"—70%; 1½" and 2"—60%; 2½" through 5"—50%.
These figures are practical for contractors with some aluminum conduit experience; may vary slightly on first aluminum conduit installation experience.

Functional Office-Shop Layout

By Hugh P. Scott

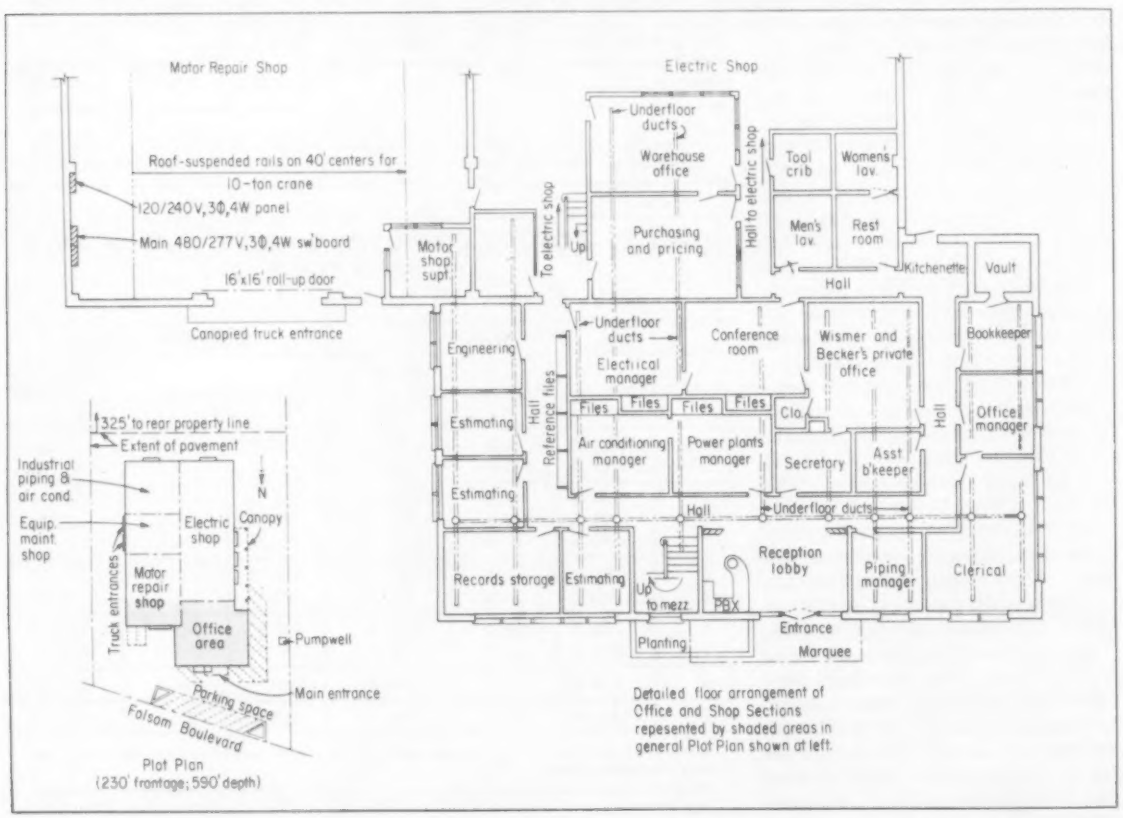
Contractors Wismer and Becker combine practical methods, modern equipment and logical floor-plan in design of their new headquarters building in Sacramento, Calif.

IN SACRAMENTO, Calif., electrical contractors Ed Wismer and Hugo Becker have just moved into new quarters functionally planned and full of useful ideas.

Take, for example, the floor-plan of their office section. Notice that a U-shaped hall surrounds a central "core" of offices, separating the core from other offices around the building's periphery, terminating in motor-repair and electric shops and providing direct access to stairways, front and side entrances, a kitchenette, lavatories and rest rooms.

Just as Wismer and Becker personally constitute the core of the organization, so their private office is placed at the physical hub of activity in the core of the building. And, just as the organizational chain-of-command next includes managers of electrical, power plant, air conditioning and piping divisions, so the offices of these managers are grouped conveniently around the office of the owner-partners.

Estimating and engineering offices are, in turn, located conveniently adjacent to their respective managers, being concentrated on



Detailed floor arrangement of Office and Shop Sections repesented by shaded areas in general Plot Plan shown at left.

OFFICES for owners and managers of electrical, power plant and air conditioning divisions are located at core of building, while estimators, engineers, clerical and other related personnel are located closely adjacent to these key personnel. U-shaped hall leads to shops at rear.

OFFICE SECTION of contracting plant on outskirts of Sacramento includes modern facade featuring all-glass entrance to reception lobby, and marquee containing recessed downlights and up-turned floods to illuminate name of firm after dark.

PARTNERS WISMER AND BECKER occupy office having panelled walls, functionally shaped furniture and luminous cellular ceiling with multi-circuiting to permit variation of intensity on working surfaces up to 180 footcandles.

the east (left) side of the accompanying plan. On the right, just across the hall from "headquarters," are offices for the office manager and bookkeeper, while pricing and purchasing facilities are centralized between the office, shops and warehouse.

Study of the plan also indicates that managerial files are staggered along a central core section to efficiently utilize space, while general reference files are located along the left-hand hall wall, available to all engineers and estimators who might wish to use them. This arrangement leaves offices and desks uncluttered except for material related to specific jobs currently at hand.

From the point-of-view of the owners; their office is conveniently placed within a few feet of a conference room, their key lieutenants and all essential conveniences. From the viewpoint of managers; they have privacy and quiet, yet are directly in contact with their assistants. And, from the point-of-view of visitors; they can wait for appointments in a pleasant, comfortable reception lobby; can be escorted directly into the offices of Wismer and Becker via the secretary's office; can proceed directly to any manager's office by way of the hall, or can go directly to an office of a specific engineer without disturbing other employees.

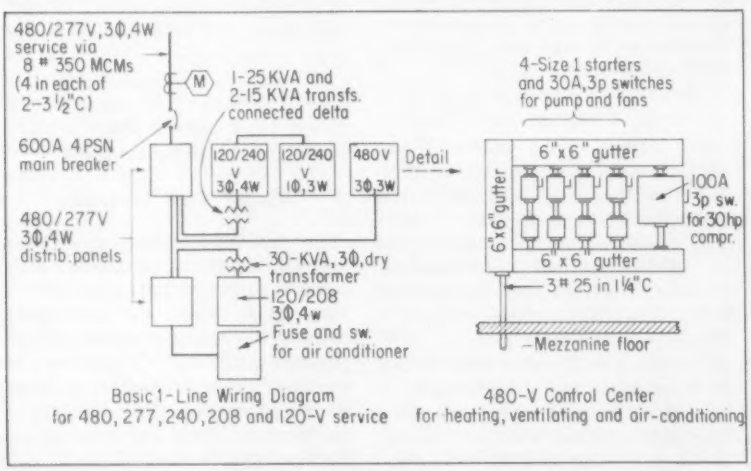
Aside from the practical layout of office space, the various rooms also serve as effective display areas, since each office is lighted by a different type of fixture and arrangement. Therefore one finds small-cell luminous ceilings (plastic and metal) in the offices of W&B and the electrical manager, (with intensities on working surfaces ranging up to 180 footcandles) while other offices are variously illuminated by the fixtures and diffusing panels.

Units are variously flush-mounted, recessed or suspended; light dispersion is variously direct, indirect or combined; luminaires are grouped in blocks, hollow squares, parallel runs or are functionally placed over desks, files, business machines and the like. And control is multi-level to show further variety to potential clients seeking suggestions for their own particular lighting problems.

Lighting in the lobby is likewise varied; including recessed downlighting over the switchboard, desk and circular planter; an ornamental chandelier above and in front of the main all-glass entrance wall; suspended luminous-globe fixtures in corners, and surface-mounted perforated-canopy luminaries placed in an attractive random pattern elsewhere.

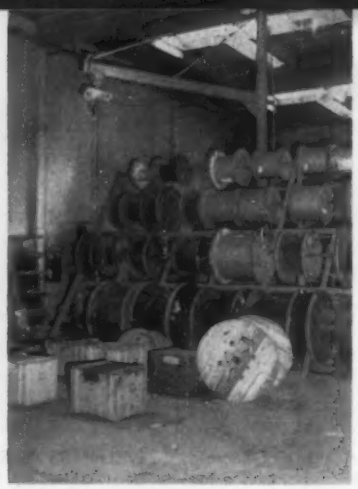
As noted, circuitry for telephone and receptacle service is carried throughout the office via 2-cell underfloor ducts; one main lateral extending beneath the front hall from east-to-west, while 11 JBs are spaced functionally in order to connect with north-south runs serving both sides of all offices. Intermediate floor inserts are positioned on 2-ft centers along all duct lines so that receptacle taps can be made in every conceivable area of the office structure.

In this underfloor installation, low-voltage power is obtained through dry-type transformers and the main switchboard (located in the motor shop) while telephone service enters the front of the building underground, connecting with the lobby PBX board and the underfloor duct immediately behind it (beneath the front stairway).



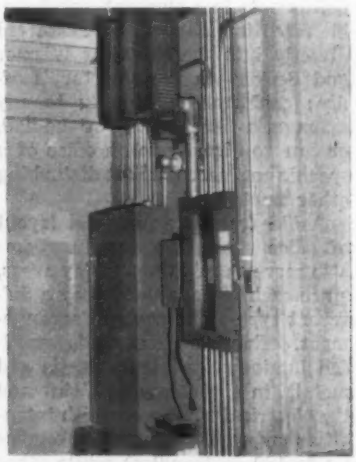
POWER FOR PLANT is received at 480/277 volts through 600-amp main breaker, while dry type transformers step this level to 240 delta, 208 and 120 volts wye, for local use. Motor control center on mezzanine compactly groups switches and starters.

SHOP ILLUMINATION is obtained through combination of 277-volt slimlines, 275-volt incandescent lamps and skylights. Laminated wooden roof trusses, spanning two 60- by 180-ft bays, support 10-ton travelling crane and provide floor-to-truss clearance of 25 ft.



HEAVY CABLE REELS are stacked on inclined framework of welded angles surmounted by remote-control motorized jib crane that moves reels as desired. A 2-ton engine-driven industrial fork-lift truck is used to shift reels between storage rack and trucking station.

ROTATING BINS are used extensively for storage of fittings and parts in warehouse. Vertical fins between bin compartments are labeled to identify contents. Bin construction varies as to number of tiers and size of bins in order to more efficiently store items in stock.



LOCAL DISTRIBUTION PANEL and related dry-type transformer are mounted on shop wall with variety of flanged angles, lipped channels, clamps and clips. All circuiting in rigid conduit is run exposed in shop areas and concealed in the office sections.

And, combining the esthetic with the functional, one finds that decor ranges from luxury wood paneling, acoustical ceilings and asphalt or vinyl floor tiling (in areas such as the lobby, partners' and conference rooms), to the use of sheet rock for partitions and ceilings in other sections of the building.

Modern Shop Facilities

Proceeding to the rear of the building, one finds that the shop area consists of two 60- by 180-ft bays, having tilt-slab pre-cast concrete sides, column footings on 20-ft centers along side-wall and center-lines, cambered glue-laminated wooden roof trusses having 25-ft floor clearances and supporting suspended crane rails, a total of eight roll-up motorized truck entrances, overhead unit heaters and ventilators that provide two changes of air per hour and 36 4- by 14-ft skylights to augment a combination of fluorescent and incandescent industrial lighting fixtures; all units (incandescent as well as fluorescent) operating at 277 volts.

Of these two bays, one is devoted primarily to electric supplies, tools and some prefabrication work, while the other is subdivided by metal-mesh partitions to define a 60- by 80-ft motor-repair shop, a 60- by 60-ft air-conditioning area and a 60- by 40-ft section for the repair of trucks and other mobile equipment.

This latter facility is by no means minor in scope, for the company operates some 60 cars and trucks, with all lubrication, motor and mechanical repair work being handled by shop personnel.

The motor shop is served by a 10-ton travelling crane; rails on 40-ft centers suspended from oversized 9- by 32-in. trusses to straddle a 16-ft-wide front trucking entrance. Shop equipment follows modern convention; for it includes an infrared baking oven, exhaust-hooded paint-spray and cleaning booths, coil winders and spreaders, equipment for sand-blasting and steam-cleaning motor frames, dynamometers and various test stands, also a liberal assortment of lathes and grinders, drill- and arbor-presses, m-g sets and multi-stage controllers.

As mentioned previously, the main switchboard for the building is also located in this shop area; power being obtained from a 3-phase 4-wire utility system at 480/277 volts through eight size 350-MCMs terminating at a 600-amp 4-pole SN main breaker.

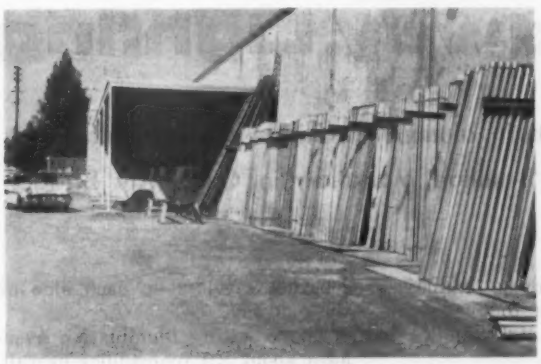
As indicated in the accompanying wiring diagram, power is then available at either 480/277 volts 3-phase 4-wire or at 480 volts 3-phase 3-wire, with a separate fused switch provided for air-conditioning equipment. Also as shown, 120/208-volt 4-wire service is available through a 30-kva 3-phase dry-type transformer, while 120/240-volt 3-phase 4-wire and single-phase 3-wire service is provided by one 25-kva and two 15-kva dry-type transformers connected delta.

Visual Tool Inventory

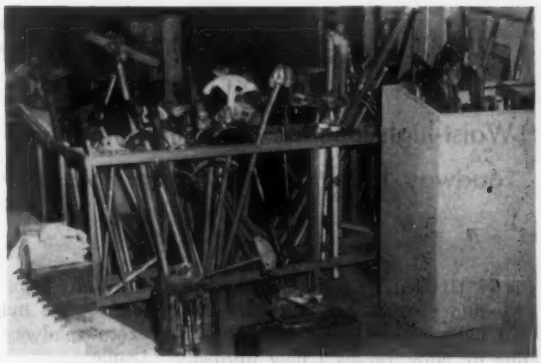
In the adjacent electric shop, several practical methods merit comment. For example, in order to keep track of all tools and equipment owned by the company, a large plywood pegboard displays a pattern of drilled brass discs or tags; each disc representing an item of equipment. Pegs are arranged in vertical and horizontal lines; each vertical line representing a separate type of tool, and each horizontal line representing a separate con-

EQUIPMENT IS RECONDITIONED on conclusion of each project, cutting blades being sharpened, all rotating and pivoting parts being lubricated, power cords being examined and repaired if damaged, metal burrs being filed or sanded smooth, and all repaired equipment then being repainted.

MOBILE WELDERS and generators, stored in paved area alongside new office-shop plant, are maintained in ready-to-go condition by company mechanics and electricians. Paved area, together with recently completed buildings, occupy approximately half of 3-acre plot.



CONDUIT is stacked against exterior wall of electric shop, which is reinforced in this area by H-columns, horizontal channels and I-beam spacers. Vertical horizontal beams projecting from concrete siding prevent conduit from toppling over.



HICKEYS, manual threaders, shovels, picks and other long-handled tools are compactly contained in angle-frame storage bins or metal-sided open-top racks, such as the one seen at the right. Location of all tools (in shop or on jobs) is indicated by respective metal disc on inventory pegboard.

struction project. When tools are in the shop, respective discs are racked together on their designated pegs in the upper horizontal row. When a tool is checked out of the shop, however, a disc is moved downward to the row opposite the job-site involved and is hung on the proper peg on that horizontal line.

In this way, all items of equipment can be instantly identified as to their locations at that moment. So, if a field foreman calls in to request an extra hydraulic bender (for example) and the pegboard shows that an extra one is in the shop, it is promptly trucked to the desired field location and its corresponding tag is shifted to the respective project line. However, if a request came in from Job X for a more-unique item (such as a diamond core drill) and the board indicated that the only one in the area was on Project Y, then a phone call would be placed to Y to see if the drill was available and, if it was, it would be promptly transferred (along with a shifting of the related disc on the pegboard) to Job X.

Shop-Cut Feeders

Another item to note pertains to storage, measurement and shipping of cable, for large reels are supported on series of horizontal shafts which, in turn, are supported by tiers of shoulder sockets secured to large inclined welded-angle racks. Reels are lifted or lowered into place either by a battery-operated fork-lift industrial truck or by a motorized remote-control jib crane placed above the rack assembly.

When calls come in for prescribed lengths of feeder, desired conductors are pulled out along the floor of the long electric shop. They are cut to length, allowing a small surplus for error in measurement, then they are reeled on disposable shipping spools and shipped to the job site. Where three or four single-conductor cables are to be used conjunctionally to form a single feeder, the several conductors are cut to equal lengths in the shop; they are arranged in parallel along the shop floor, then are reeled as a unit so that, when unreeled on the job, they can be pulled into a conduit or wireway without further juggling.

Determining desired conductor lengths on the job is accomplished simply by fishing a steel measuring tape through the conduit in question, noting the overall length between terminal points, then phoning this distance in to the shop together with gauge and insulation information. Measuring conductors at the shop, rather than shipping entire reels to job sites, has resulted in minimizing essential inventories of cable, eliminating of double trucking (to and again back from the project) and reducing manpower required to measure, cut and pull individual conductors under field-varying (rather than shop-fixed) conditions. Also, since disposable reels are used for this intermediary shipping procedure, there is slight loss if reels are not returned to the shop.

RAIL-MOUNTED fluorescent luminaires light the 4-lane roadway of the New Jersey Manahawkin Causeway Bridge uniformly, provide many advantages, and may prove to be a new approach to many roadway lighting problems.

Railing Luminaires for Roadway Lighting

Waist-high location of 42-in. fluorescent units in aluminum railings provides glarefree roadway lighting for New Jersey's new $12-million Manahawkin Causeway Bridge.

AN UNUSUAL and pace-setting fluorescent roadway lighting system has been installed on one of New Jersey's new highway bridges which merits special attention and consideration. It consists of 768 General Electric 42-in. long fluorescent one-lamp luminaries mounted in the aluminum railings along each side of the bridge, 50 ins. above the roadway surface, and spaced approximately 30 ins. apart, or on 5-ft. 6-in. centers. The luminaires are properly angled to direct the light rays from the luminaires across the bridge's four-lane concrete roadway at right angles to traffic.

This unique lighting installation is on the Manahawkin Causeway Bridge across Manahawkin Bay, N. J. Highway 72, connecting Manahawkin on the New Jersey mainland with Long Beach Island, an 18-mile stretch along the Atlantic Ocean. It is located about 30 miles north of Atlantic City.

The aluminum railings are elliptical in shape, extruded, and were supplied in 12-ft lengths for assembly at the job. Cutouts were provided in the lower front (roadway) quadrant of the railings for the 42-in. luminaires.

Each luminaire contains a specially designed polished Alzak aluminum reflector which directs a concentrated asymmetric light distribution pattern across the roadway from a single F42T6/CW fluorescent slimline lamp, through a clear plastic cover. Two lamps from each of two adjacent luminaires are controlled from one 2-lamp ballast, which is mounted in a housing recessed in the sidewalk opposite upright posts which hold the railings in place.

Ballasts are fed by a 120-volt single phase service, over a 3-wire 120/240-volt system. Service is supplied over the 2400-ft-long span from each end of the bridge, with separate services on each side of the roadway.

The resulting illumination averages about 2.5 footcandles overall, and is relatively uniform, as can be noted in the photo above.

This unique lighting installation brings to realization a "pet idea" which N. J. State Highway Commissioner Dwight R. G. Palmer first conceived about ten years ago. The Highway Department engineers reported tests conducted on the bridge served to "unreservedly confirm" the installation plans, completed in 1956. Experiments were conducted on this specific design as far back as 1954.

The Highway Department lists several advantages for this low-mounted lighting system including elimination of glare, all light directed to the roadway leaving the parapet in shadows and thus directing the driver's attention to the roadway, greater effectiveness in fog, rain or snow because of the horizontal direction of the light, and easier servicing without any roadway obstruction since the lights are readily accessible from the bridge walkways.

Electrical contractors for the Manahawkin Causeway Bridge project were Henkel and McCoy, of Philadelphia. The extruded aluminum rails were supplied by the Michael Flynn Manufacturing Company of Philadelphia.

42-IN. LUMINAIRE is installed in lower quadrant of elliptical extruded aluminum railing, and is being inspected by (L-R) A. M. Cook, G. E. Engineer, D. J. Henderson, Chief Electrical Engineer of N. J. State Highway Department, and V. W. Kafka, G. E. Engineer.

Small Industrial Electrical Systems

Long-range considerations related to effective maintenance include analysis of load studies and existing capacities, preferable voltage levels and the grounding of neutrals, selection of switchgear plus breakers vs fused equipment.

By William D. Bonser, *Engineer and Assistant Superintendent, Larsen-Hogue Electric Company, Los Angeles, Calif.*

INSTALLATION and maintenance of electrical distribution systems in small industrial plants constitutes a large part of our business. In that endeavor we encounter numerous problems pertaining to revision or expansion of inadequate installations. Some of these inadequacies can be traced back to initial designs that covered only bare-minimum, then-existent requirements. Others can trace their obsolescence to normal plant expansion and load growth. In all instances, however, present problems are basically related, for their existence generally can be traced to the common heritage of short-range planning. Thus limited in flexibility or capacity, older systems prove incapable of satisfying present increases in power demands or changes in production patterns.

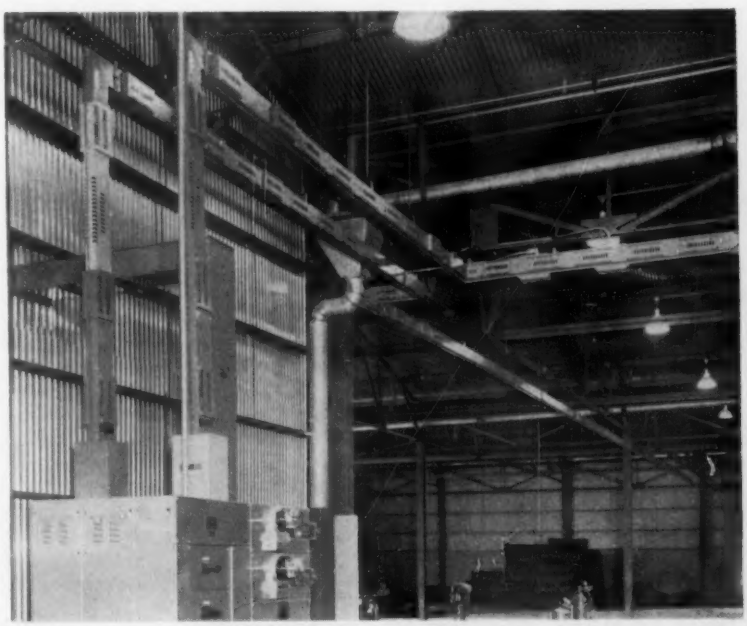
Maintenance engineers inheriting such limitations cannot be held responsible for initial omissions. They should, however, feel obligated to up-grade their installations whenever opportunities for so doing arise. And, if up-grading is to follow any logical progression, every change or addition should represent a coordinated step taken in the direction of a desired over-all objective. Only by relating intermediate steps can an end-result of intelligent modernization be fully realized.

Since management necessarily must be consulted before major changes or revisions of systems are undertaken, maintenance men would do well to keep management informed constantly concerning approaching overloads, inadequate control methods or equipment, recurrent faults, or the latest thinking regarding progressive distribution practices. Then, should emergency conditions demand prompt decisions, these preliminary briefings should prove helpful in having contributed to the creation of a "receptive mental climate."

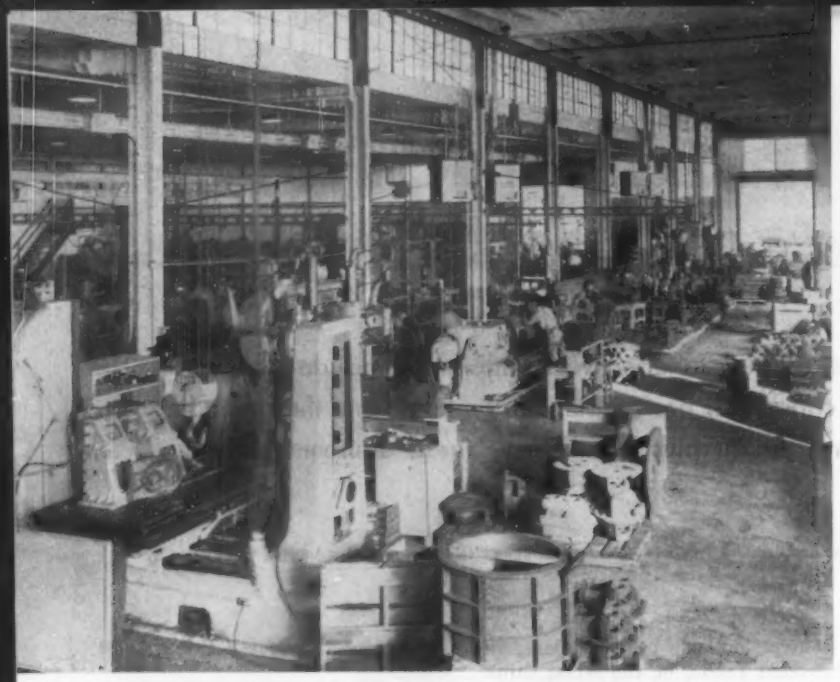
Since thorough understanding is essential for logical planning, such pre-briefings should prove to be strong arguments when approvals are requested for contemplated work.

Pre-briefings should likewise serve in justifying reasons behind requests, and such "subtle selling" can definitely pay dividends if management is kept informed concerning the "why" as well as the "how."

A most-effective argument in emphasizing the importance of electrical systems is to "capitalize" on actual shut-downs, asking management to inspect a plant when men



LIBERAL USE OF BUSDUCT and high-quality switchgear in this small industrial plant provides ample flexibility and capacity for future as well as existing load requirements, insuring continuity of electrical service and maintenance of production schedules.



DUE TO FLEXIBILITY of distribution system in this machine shop, operations have never been interrupted although rearrangement of equipment has been frequent.

and machines are idle. If all other pleas for maintenance funds are being ignored or are being "tabled for future consideration," the sobering picture of production halted, while overhead costs continue, is indeed a persuasive argument in favor of preserving electrical continuity.

In discussing long-range plans for small industrial electrical systems, two questions should be answered. First, how large is a *small* plant, and what items should be included in the plan?

In this discussion, let us define a small plant as one having (1) three or fewer maintenance electricians, and (2) *not* having a distribution system operating at primary voltage level.

And, in considering long-range plans, let us take into consideration such items as (1) capacity and flexibility, (2) voltage levels, (3) grounding of neutrals, (4) fuses vs breakers, and (5) switchgear.

Capacity and Voltage

Making process changes, adding extra machines or additional motors are becoming so commonplace today that their cumulative contributions to system overload is often overlooked, or, at best, ear-marked for further study at a more-convenient future time.

Large load increments, such as major relighting programs or installations of electric heating processes, are readily recognized as load-growth increments, yet all too frequently the gradual summation of small additions remains unheeded, "apparently" requiring only additional branch circuiting and connections.

Keeping industrial electrical systems safely ahead of load requirements therefore calls for routine recording of all load changes as they occur. These changes can be obtained from routine work orders, and their effect upon feeders, switchgear and transformers should then be closely estimated. In fact, if these up-to-date conditions are noted on an always-visible wall-mounted wiring diagram for the information of all responsible personnel, remedial action can be anticipated and scheduled before conditions become critical.

Hand-in-hand with capacity goes thinking concerning flexibility. And, especially in plants where changes in production routines call for frequent shifting of equipment and loads, provision for such additions and transfers should be provided for through the existence of plug-in busduct, load centers or other types of readily-connected distribution mediums.

When considering major alterations or load additions, it also is a good time to review existing and desired voltage levels, remembering that higher distribution voltages will effect savings due to reductions in sizes of cables, switches, starters and conduit.

For most small plants, 480-volt distribution is quite satisfactory; so, except in very damp locations, we do not recommend the use of 240-volt systems. When a higher voltage level seems advisable, we recommend 4160 rather than 2400, inasmuch as actual maximum voltage-to-ground on 4160-volt systems is no greater than for 2400 volts, and, under fault conditions, it is less. For 4160-volt systems, 5-kv switchgear and non-shielded cables may be used, neither requiring special skills either for installation or maintenance. In some instances, of course, 2400-volt systems are prescribed due to the existence of special loads such as 2400-volt motors or welders, but, except for these conditions, we advocate the higher level.

For small plants, higher voltages such as 6900, 7200, 16,500, etc., should be used only if they are the only levels available, or if connected loads are up in the order of 7,000 hp or more. These voltages *do* require special attention, both during installation and in maintaining the systems. It is also essential to keep insulators thoroughly cleaned, oil checked frequently for acidity and dielectric strength, and all equipment regularly cleaned and checked against manufacturer-recommended operation characteristics.

Manufacturers' recommendations are most important, for they know their equipment better than anyone else. And, since they obviously do not want anyone to have trouble with their equipment, they will gladly furnish information concerning proper application, installation and maintenance.

To illustrate the importance of following instructions to the letter, we recently installed a 10,000-kva 16½-kv service, using shielded rubber cables. Shortly afterwards, the customer wanted to add current transformers in the system. Assuming that the work involved was the same as for a 480-volt system, the plant maintenance crew cut the feeders ahead of the stress cones, installed the CTs, re-energized the system—and promptly had an explosion causing approximately $5,000 of damage. Then and only then, we were called upon for service. And, in making the repairs, we

followed the standard set of instructions put out by the cable manufacturer, which we obtained for the price of a phone call. The point of this illustration is: find out the correct way of doing a thing *before* you do it. And, if you have doubts about your own abilities, don't hesitate to call upon recognized authorities.

Controversial Questions

Two recurrent questions concerning distribution systems in small plants are: Should we ground our neutral, and should we use fuses or breakers?

Both of these questions are controversial, so our recommendations do not reflect universal unanimity of opinion. However, when considering a 480-volt system, you either have a neutral or can create one, and we definitely prescribe using this feature.

The primary reason for so doing is safety to personnel, for one of the most common hazards in working on an electrical system is to encounter "hot" equipment caused by a live conductor wearing through its insulation and then coming in contact with the metal enclosure. With a grounded neutral, this condition would clear itself by opening the fuse or breaker. And, in addition to this, there is the added safety value of having a maximum of 277 volts to ground, rather than 480.

During conditions of fault, voltage values on ungrounded systems can rise to several times normal, damaging motor insulation and creating a potential weakness which may result in motor burn-outs months after the original fault has been repaired.

Then, of course, there is a bonus feature related to a 480/277-volt system, since fluorescent and mercury-vapor lighting systems can be utilized with considerable economies.

The question of fuses vs breakers is another controversial one, for personal experience with both types of devices varies widely. In our own experience we have found that, surprisingly, the greatest number of fuse and switch failures occur at the relatively low voltage level of 240, when amperage values are correspondingly high.

However in many cases, especially in small-motor circuits, using fuses in 240- and 480-volt systems has the plus-values of economy, greater flexibility and faster operation than breakers.

In considering load-carrying ratings, we have good reason to believe that breakers have higher values in supposedly identical classes, a case-in-point being an installation in one of our customer's premises where a 600-amp breaker fed into a bus-duct serving four small machines plus an extrusion press having a 600-amp main switch. The customer reported that the switch ran hot constantly and the 600-amp fuses had blown repeatedly, although the main breaker had never tripped or become warm.

It is also our conclusion that breakers are less susceptible to failure from moisture, dust and rodents, while another advantage is the fact that, when they do open, they do so in all legs simultaneously.

At higher utilization levels of voltage, each application should be studied as an individual problem, remembering that breakers have advantages of reclosing speed, and they will not cause single-phasing. They are, however, more expensive. On the other hand, fuses clear faults faster and have higher interrupting capacities.

In considering these problems, your serving utility-company engineers can be of considerable help, for they know what IC you require to interrupt their primary power characteristics (and also they prove most cooperative in helping promote the previously-mentioned "mental climate").

MOTOR CONTROL CENTER in new plant reflects competent workmanship, although any future changes or additions would be difficult due to lack of spare capacity or available space at this location.

Selecting Switchgear

In considering what type of switchgear to use, we have found that in the long run it almost always pays to use convertible switchboards rather than switch-and-gutter boards. For approximately 20% added cost, the switchboard will provide greater flexibility and reliability.

Location of switchboards likewise is important, for they should be in clean, dry environs. If that type of location is not available, it either should be created, or equipment should be specified having enclosures designed to meet the atmospheric conditions that do exist.

Along with switchgear, one should consider the use of bus-duct, which admittedly may boost initial costs by 50% but will provide the advantages of far-greater flexibility and capacity. Remember that a bus-duct system is actually a combination distribution system and switchboard and, after "selling" the first installation to management, you will find that subsequent installations will be approved automatically.

Another subject to consider at this point is instrumentation. For example, it is generally good practice to install an ammeter in the main line, for this can save considerable money by accurately indicating true load conditions, and it will also prove of value when seeking approvals from inspectors. And, if your system is not grounded, you should have a set of ground lamps.

For example, if 600-volt cable is being used, the extra investment in Type RHRW will buy far greater value than that provided by TW and it will keep feeder problems to a minimum. For higher voltages, we recommend rubber or synthetic insulations, depending upon existing conditions.

In conclusion, a word of caution concerning used equipment should be added. But, regardless of whether your system consists of new or old components, remember that it is to your advantage as a maintenance man to constantly upgrade your system, adding only strong links to the chain, for only in that way can you achieve your long-range objective of minimizing worry, eliminating shut-downs, maintaining flexibility and keeping ahead of load requirements.

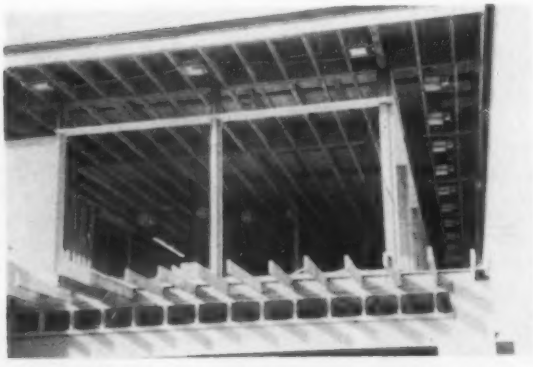
POSTLIGHT in left foreground is controlled by photocell; garage doors at right are operated by radio; all lighting is switched by low-voltage relays.

SERVICE ENTRANCE equipment, including metering facilities, 400-amp main switch plus four 100-amp and two 30-amp feeder breakers related to local control panels, is located in concrete-block recess adjacent to motorized garage doors.

SAN DIEGO

Gold Medallion Home

All-electric home of Norman Ferguson, president, California Electric Works, features advanced practice in heating, lighting, communication and controls.

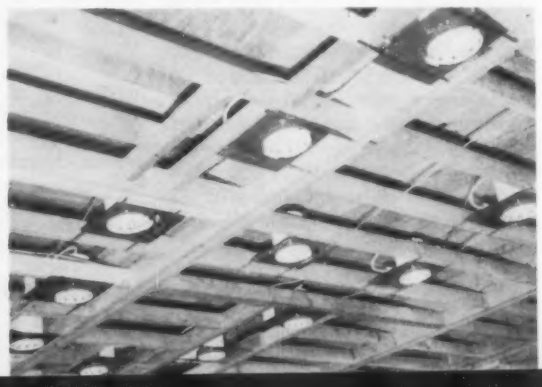


GLASS WALLS of living-and dining-room are shielded against direct sunlight by wide overhanging eaves containing series of square lensed recessed downlights for night-time use. Sills beneath glass level are also equipped with weatherproof spring-receptacles.

LIVING ROOM lighting consists of illuminated valances, downlights above ornamental stone fireplace, hanging fixtures in one corner, plus table lamps functionally placed alongside several chairs in this attractive setting. Eave-recessed downlights are placed directly outside of two glass wall areas.

TWO-FACED FIREPLACE separates living room from dining area, where annular-louvered downlights in three colors can be dimmer-regulated to permit variance of patterns and intensities to suit changing moods or dining arrangements.

OVAL ARRANGEMENT of recessed downlights in dining area is alternately lamped with pink, gold and blue bulbs, each color separately controlled by auto-transformer dimmer. Downlight projects white light to tabletop.



MAIN KITCHEN has complete array of electric wall ovens, built-in grille and appliance center, refrigerator and freezer units, dishwasher and food disposal, intercom and radio, valance and downlighting, heating and ventilation provisions. Second kitchen on lower level of home simplifies entertaining in rumpus room or outdoor patio. Separate 100-amp 110/220-volt breaker panel serves appliances and outlets.

WALL RECESS located above twin-bed headboards in master bedroom contains full-width wiring strip for plug-in connection of clocks, radio, bedlights, etc.; master-control low- voltage station related to key lighting both inside and outside the house; intercom speaker; telephone jack and local 24-volt relay control panel for lighting and switched receptacles within the room itself.

BEDROOMS FOR CHILDREN are generally illuminated by fluorescent cove treatments, ornamental hanging luminaires, plus local lighting for desks. Note upward lighting component directed towards shelf above study table, also intercom speaker.

LIGHTING PLAN in recreation area includes valance with adjustable faceplates, swivelling eye-ball floodlights over a wall bookcase, plus several varieties of recessed and semi-recessed lensed and louvered ceiling units.

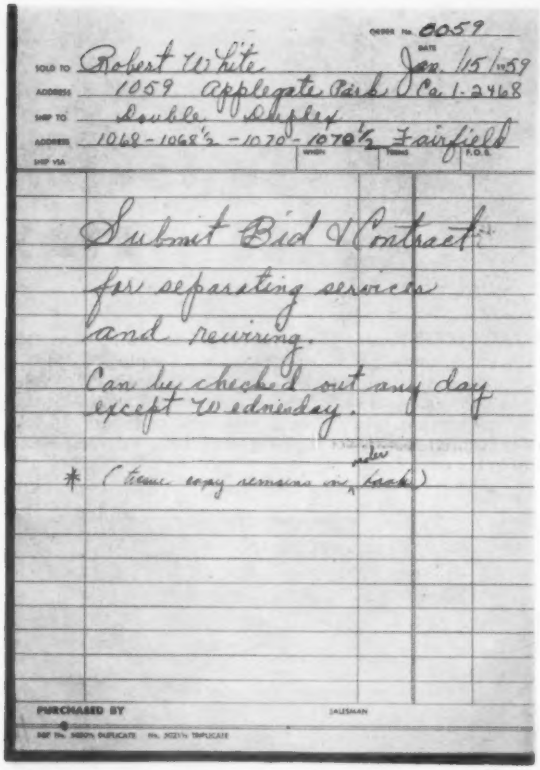
ELECTRIC HEATING circuits related to baseboards in bathrooms, plus resistance cables carried in ceilings of other rooms and in slab of patio terrace, are controlled through individual branch circuit breakers in a separate 100-amp 220-volt panel located in lower-level kitchen adjacent to recreation room.

PATIO TERRACE is radiantly heated by resistance cables in the slab. Illumination is provided by suspended plastic luminous globes placed above doors and outdoor stairs, ornamental garden lighting for adjacent plant and flower beds, perforated-canopy surface-mounted and frosted-lens recessed fixtures mounted beneath overhanging 2-level eaves of home.

Adequate Job Records

How an Ohio contractor developed a Job Control System that records each job's operation—from the initial inquiry to final payment and filing.

By Esther P. Hedrick, Co-owner,
Hedrick Electric Co.


ORDER No. 0059

SOLD TO Robert White — DATE Jan. 15 1959

ADDRESS 1059 Applegate Park — Ca. 1-2468

SHIP TO Double Shipley

ADDRESS 1068-1068½-1070-1070½ Fairfield

SHIP VIA — WHEN — TERMS — F.O.B.

Submit Bid & Contract for separating services and rewiring.

Can be checked out any day except Wednesday.

* (Items copy remains in order book)

PURCHASED BY — SALESMAN

FIG. 1—Job order sheets list the customer's name, address and telephone number, plus a brief description of the work to be accomplished. Note write-in order number in the upper right-hand corner of the form.

MANY of today's business articles and statistics tell us that one of the prime reasons a number of our country's smaller firms do not profit in business is because operators of these firms do not appreciate, or keep, adequate records. If this criticism is just, and I believe that it is, then we, who make up this great number of small businesses, need to know how to keep the necessary records. We must also realize how and why these records can be of value to us.

There are of course, many different kinds of records; each deserves its own thorough study and attention. In this article we shall discuss only an adequate system of *Job Record Keeping*. This is perhaps the most neglected area in record keeping systems; ironically, to small firms, and particularly to small contracting firms, this is one of the most important areas.

Here in our office at Hedrick Electric Company we have found that the keeping of adequate and complete job records is one of our best investments. Aside from the fact that regular record keeping makes all mandatory reports (Federal, State and Local) much easier to compile at the time they are due the keeping of good job records keeps us supplied with an abundance of information from which we can quickly determine the following:

(1) How successful our past performance on jobs has been.

(2) How to properly evaluate jobs to make successful bids.

(3) How to base reasonable advance estimates on future sales.

(4) Whether our inventory is in order.

(5) Which employees are the most productive.

(6) Whether our job costs as a whole are in line.

(7) What kind of jobs are the most profitable.

(8) Whether we are increasing our customer following.

Job Order Sheets (Fig. 1): The forms we use have 50 sets of order sheets to a book. Each set consists of a white original with duplicate sheets in yellow and tissue. The sheets are numbered consecutively, starting with the number 0001 at the beginning of each year. Every job during the year is then numbered in the order it is received. Requests for quotations, as well as job check outs, are written up as job orders. In this way we account for every order or request that is received.

Job Record Cards (Fig. 2): Ours are approximately 6 by 9 ins. We use these cards to record the customer's name, address, job location, material listings, amounts of labor, permit and inspection fees, and any other data pertinent to the job. On some of our larger jobs it is often necessary to use more than one card. When this happens, we number the cards and use a final summary card to combine the labor and material totals.

Aluminum Clip Boards: Each workman and supervisor is furnished with one of these boards that hold tablets of white ruled writing paper. Our workmen use the tablets to list their time, material used, and the location of the job. We have

Job Record Sheet

Our W. O. No. 0059 Date Ordered Jan. 15, 1959

Your W. O. No. _____ Date Completed _____

Name White, Robert Address 1059 Applegate Park Telephone CA-1-2468

Authorized By Mrs. White Work to be done at Double Duplex 1068-68½-70-70½ Fairfield Telephone _____

Description of Work Submit Bid and Contract for operating services and rewiring. Can be checked out any Day except Wednesday.

Quantity	Size	Material	Cost Ea.	Cost Ext.	Selling Price Ea.	Selling Price Ext.
		2-3-59				
		Checked out job				
		Mailed out bid same afternoon				
		2-4-59				
		Signed Contract returned				
		Job scheduled to start 2-10-59				
		2-10-59				
		Rewire. started. Material list to be brought in by FDH.				
		* (Material list is continued on opposite side)				
		(OVER)				

Labor Charge for Month of Feb. 1959

Date		2/2	2/10				
		S	M	T	W	T	F	S
RRH			1	4				
F.D.H.				8				
R.M.H.				4				
A.M.C.				8				
Total Hrs.								

Summary

	Cost	Selling
Material		
Labor		
State Tax		
Federal Tax		
Permit Permit (a) - 2-4-59	3 00	
Total		
Date Billed		
Date Paid		

FIG. 2—Job record cards present a complete picture of every job. Aside from listing the customer's name, address, etc., the cards are also used to list material used, the amount of labor expended on the job, and job location. The opposite side of the card contains additional space for material listings. On very large jobs when more than one card is required, each additional card is numbered and a final summary card used for material and labor totals.

found that ordinary writing paper works better for our workmen's daily reports than any of the printed forms we have investigated.

Individual Weekly Time Books (Fig. 3): For each workman and supervisor we keep a weekly time book. At the beginning of each day we copy from each man's daily work sheet the time recorded for the day previous. The time books are for our official office records, and our men never make their own entries or take them out on the job.

Filing Cabinet Drawers for 6-in. by 9-in. Job Cards: Our cabinet drawers are separated into sections labeled as follows: (Sec. 1) Active Job Orders; (Sec. 2) Bids Open; (Sec. 3) Completed Job Orders with invoices. Paid Invoices are kept in a separate set of file drawers.

For general bookkeeping, that is sales and receipts, we use the Ideal System General Business and Tax Records. The system has proven highly successful for our operation, although there are many other excellent bookkeeping sets available. In order to keep special records, we

R.R.H.

Time for the Week Ending Feb. 12 1959

No.	Names	S 8	M 9	T 10	W 11	T 12	F 6	S 7	Total Time	Rate	Amount $	Amount Cts.
8:30-12:00	48 Hawthorne						3½					
12:00-12:30	Lunch						0					
12:30-3:00	48 Hawthorne						1½					
3:00-3:30	1950 Fairway						½		8			
3:30-3:00	2004 Frankfort						½					
3:00-5:00	1411 Remington St.						2					
8:30-5:00	(Fuse + Rx. lunch Franklin Co. 30)		8						8			

FIG. 3—Weekly time books are kept in the office on every workman and supervisor. Manhours are posted to the time books from individual daily work sheets turned in by the electricians at the end of every work day.

order extra pages for our journal that have eight blank columns. Using these blank column sheets, we set up additional records concerning jobs that are of great value to us. We place a quantity of these sheets in the front of the journal and divide them into three sections. (Sec. 1., Fig. 4): This section consists of a numerical listing of all jobs in the order they are received. By taking a quick check of this section I can tell in seconds whether job calls are coming in on an average basis for any particular month. (Sec. 2., Fig. 5): In this section we keep a daily listing, plus a cumulative total of jobs billed. This enables us to make a quick check on our total sales to date at any given time. (See 3., Fig. 6): This last section contains a daily listing of payments received, plus a cumulative total for the year to date.

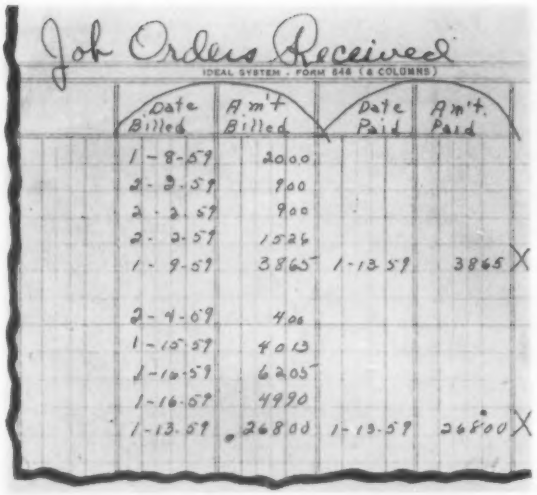


FIG. 4—Section 1, extra journal sheets consist of a numerical listing of all jobs in the order they are received. A quick check of this section shows if job calls are coming in on an average basis. The "X" in the column to the extreme right shows that the job is completed, paid in full, and filed.

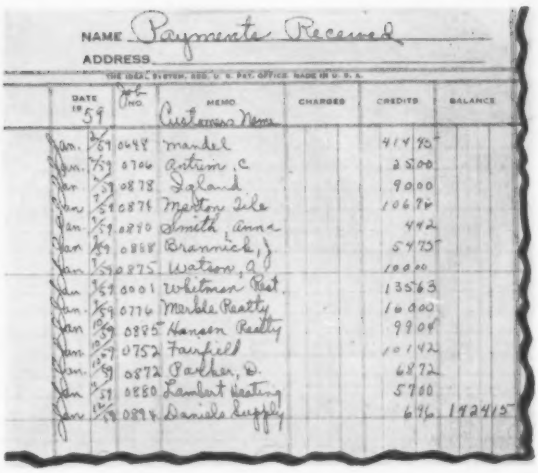

NAME Payments Received
ADDRESS
DATE 1959
JOB NO.
MEMO
Customers Name
CHARGES
CREDITS
BALANCE
Jan. 1/59 0648 Mandel 414 75
Jan. 1/59 0706 Antrim, C 25 00
Jan. 1/59 0878 Doland 90 00
Jan. 1/59 0876 Morton Isle 106 74
Jan. 1/59 0870 Smith, Anna 4 42
Jan. 1/59 0858 Brannick, J 54 75
Jan. 1/59 0875 Watson, J 100 00
Jan. 1/59 0001 Whitmer Real 135 63
Jan. 1/59 0776 Marble Realty 16 00
Jan. 1/59 0885 Hanson Realty 99 08
Jan. 1/59 0752 Fairfield 101 42
Jan. 1/59 0872 Parker, D 68 72
Jan. 1/59 0880 Lambert Heating 57 00
Jan. 1/59 0894 Danida Supply 6 76 1924 15

FIG. 6—Section 3, extra journal sheets are used for a daily listing of payments received, plus a cumulative total of the year to date.

At any time, we can take the cumulative total of the year to date at the end of section 2 and subtract from it the cumulative total at the end of section 3. This will then give us the amount of our accounts receivable at that particular time. This amount must equal the amount due on invoices attached to job cards in the accounts receivable file. The total must also be equal to the total on a tape run on the balances due in our customer ledger book. It is our habit to prove this balance once a week. It might be well to mention here that we have been informed by several attorneys and accountants that this particular bit of record keeping makes their work much easier, and that it establishes good proof on year-end reports.

It is not possible to place too much emphasis upon the importance of having the detailed work, which I am about to describe, done in exactly the same manner by each and every person who may be handling the job records. Four persons assist me in our office on a part-time basis; this makes a total of five different persons apt to be handling the job records. Only the fact that we have a definite and regular daily procedure keeps our office from getting into a state of absolute confusion. We have found that by sticking to the same procedures, done in the same order each day regardless of who may be working in the office, any one of the five of us may take over another's job without fear of doing repetitious work. Personally, I feel that any contractor who knows simple grade school arithmetic can perform good job record keeping. It is the setting up of regular procedures and following them each day that does the trick.

Writing Up the Job Order

When taking a job order we make it a point to get the following information recorded on our job order sheet. (Fig. 1): (a) Name, address and telephone number of the person authorizing the job. (b) Name, address and telephone number of person who occupies the premises where the work is to be accomplished (excluding new buildings). (c) Description of the work to be installed. (d) The arrangements necessary to let the workman into the building, who to see, owner, occupant, or janitor, etc; plus the month, week, day and time the work is to be started. So far the blank forms that we use for this purpose are more to our liking than any of the printed forms available. (Although, we are presently working on a detailed form which we may have printed in quantity after we are absolutely certain it will meet all our requirements.)

After the order is written up on the job sheet, we remove the white and yellow copies from the order book, staple them together and place them on our supervisor's desk. Then we immediately write up a corresponding job record card (Fig. 2) copying exactly the same information contained on the job order sheet. Our bookkeeping desk sees no more of the job order sheet until after the job is completed and the sheet is returned to our desk marked ready to "bill."

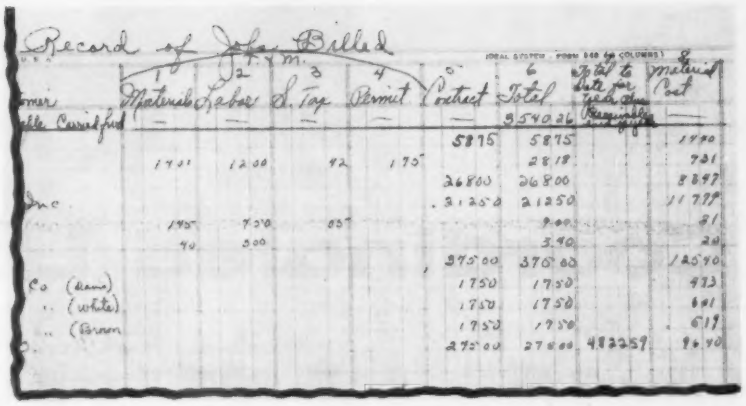
Our workmen may all work at the same location on one day or they may be sent on separate jobs. As they meet at our shop in the morning, our supervisor hands them their aluminum clip boards that contain tablets of lined writing paper, plus each particular electrician's job order sheets. The sheets are clipped to the board in the exact order the jobs are to be taken care of. Finally, just before each man leaves for his assigned job or jobs he puts his name and the date on the top line of the top sheet of his writing tablet. During the day the men keep their own record of time, descriptions of the work accomplished, plus listings of the materials used. At the end of the day, our supervisor looks over each man's daily report sheet. If he is satisfied with it he tears it (or them) out of the tablet and places all of them in a work basket on our bookkeeping desk.

We start our day's routine at job record keeping by copying the electricians' time for the day previous (recorded on their daily work sheets) in our weekly time books.

(Fig. 3) We begin with the supervisor's time book, then the books of the other men in alphabetical order according to their last name. The time books are handled in the same order each time they are worked on, whether it be for job records or payroll. Now that we have completed this procedure, we begin our second operation. Again taking the supervisor's time book first, we look through Section 1 of the 6-in. by 9-in. card file (active job orders) and pull from this section all job cards called for by the recent entries in the time books. After we write in the date of the month, each man's time is entered on the job card directly across from his initials under the proper day of the week. As we enter each item, we make a check mark by that particular entry in the time book. This shows that the time has been entered on the job card. When we have all the time entered on the proper cards we file the time books (still in alphabetical order) and they are ready for use the next time we need them.

Now we are ready to work on the daily report sheets; as we enter the men's reports of work accomplished and material used on the proper job card we cross each item off of the corresponding report sheet. If we do not completely understand an entry, we hold it until the electrician responsible checks in at the end of the day and then clear it with him. When all the items on each man's report sheet are transferred to the corresponding job cards and all items scratched off the report sheets, the sheets may be destroyed or put in an inactive file.

The next step is to take all the job order sheets marked ready to "bill" and match their numbers with corresponding numbers on the job cards. This is extremely easy if both items are arranged numerically first. Another good reason for having the cards stacked in order numerically at this time is because we are getting ready to figure the cost and selling prices of the jobs ready to be billed. And, if we have the jobs arranged in numerical order we are sure of billing the oldest jobs first. We find figuring the price of a job while it is still fresh in our mind is very important.


Record of Jobs Billed

	1 Materials	2 Labor	3 S. Tax	4 Permit	5 Contract	6 Total	Total to date for this job	Material Cost
						9540.26		
					5875	5875		1490
	1491	12.00	92	1.75		28.18		731
					26800	26800		8897
Inc					21250	21250		11777
	195	7.50	05			9.00		81
	90	5.00				3.90		24
					37500	37500		12590
Co (Ivory)					1750	1750		933
.. (white)					1750	1750		691
.. (Brown					1750	1750		619
					27500	27500	483257	9690

FIG. 5—Section 2 extra journal sheets contain a daily listing, plus a cumulative total of jobs billed.

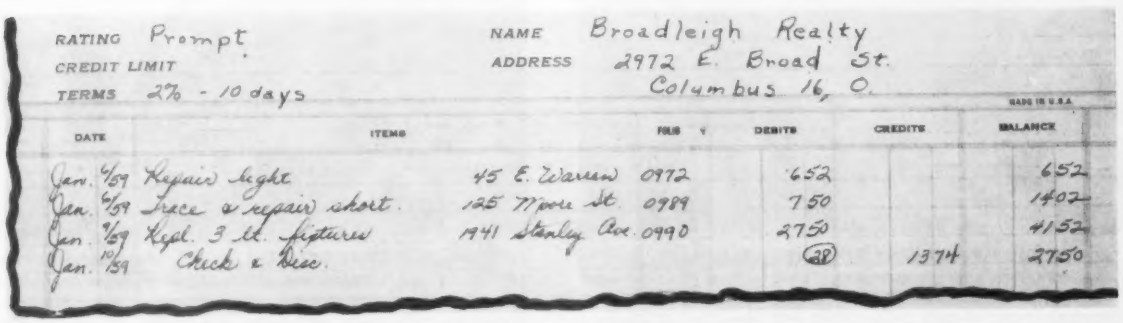
The daily office routine, as I have just described it, (up to this point) does not take any of our office staff over half-an-hour on any average day. It is amazing what we have learned from the half-hour spent daily on this portion of our record keeping. Of course, the time spent on pricing out the various jobs will vary depending on whether the job is large or small. Therefore, we cannot estimate this time to advantage.

In the latter part of the morning, when we have most of the job cards priced out, Mr. Hedrick reviews each job and is quick to notice those which seem out of line in price or amount of hours consumed. I should point out here that we will have added into each job summary in the lower right hand corner of the job record card, sales tax on materials, plus permit and inspection fees.

After we have typed up invoices for jobs ok'd by Mr. Hedrick for billing, we clean up any miscellaneous items and begin working on the pricing of the held-over job cards. We have found that we can do better thinking on the pricing of involved jobs when our mind is free from the pressure of other details.

The stack of numerically arranged job cards, for which we have just typed invoices, are placed to the side of our "Red Book" (which we call our bookkeeping set). We then enter the amounts of the invoices in section 1 and 2 of the special sections, which we have made up for our own use and which are illustrated as Figs. 4, 5 and 6. Next we enter the amount and identifying job data on the customer page in our looseleaf ledger, (Fig. 7).

(Continued on page 205)


RATING Prompt
CREDIT LIMIT
TERMS 2% - 10 days

NAME Broadleigh Realty
ADDRESS 2972 E. Broad St.
Columbus 16, O.

DATE	ITEMS	FOLIO	DEBITS	CREDITS	BALANCE
Jan. 4/59	Repair light	45 E. Warren 0972	652		652
Jan. 4/59	Trace & repair short.	125 Moore St. 0989	750		1402
Jan. 9/59	Repl. 3 lt. fixtures	1941 Stanley Ave. 0990	2750		4152
Jan. 11/59	Check & Desc.		(38)	1374	2750

FIG. 7—Customer's ledger lists all invoices, plus identifying job data. For customers on a "one time" basis, several accounts are listed on a single page.

Coordinated Lift

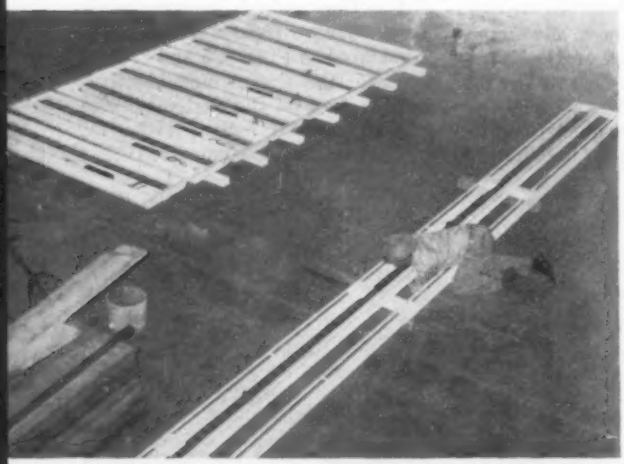
. . . raises 64-ft-long pre-assembled lighting run into mounting position as single unit. Method was used by Oakland, Calif., contractors Schwartz and Lindheim during market electrification.

THAT a job doesn't have to be large in order to "justify" the development of time-saving techniques is a premise that can be effectively illustrated by considering a small market lighting installation in Richmond, Calif. Handled by contractors Bob Schwartz and Steve Lindheim of Oakland, the Town Market required just eight rows of lighting units, each row consisting of eight 2-lamp 8-ft slimline fixtures. These are suspended beneath a white-painted ceiling and, since fixtures are liberally slotted to permit sizable components of light to pass upwards, ceiling-fixture brightness contrasts are minimal and this relatively inexpensive unshielded installation is proving completely satisfactory for its purpose.

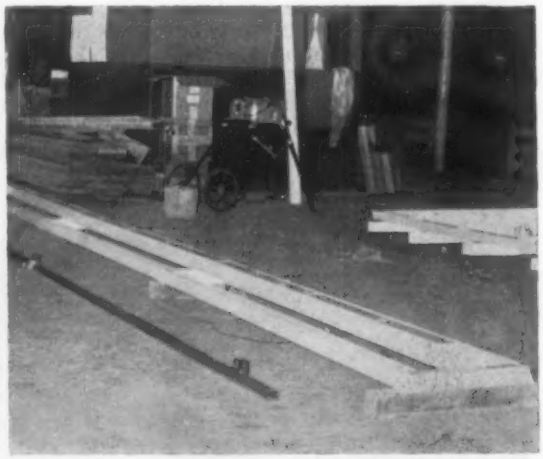
As indicated by the series of accompanying photographs, this installation was pre-assembled at floor level, even to the insertion of lamps; then complete rows of fixtures were raised into position as 64-ft-long units.

In step-by-step detail, fixtures were first uncrated from shipping cartons, checked for condition, then stacked upon these cartons in groups of eight for convenient subsequent assembly and to keep them off the floor, thereby preventing possible scuffing or marring of enamel finish.

Each group of fixtures was then positioned end-to-end and bolted into a continuous run, intersection points being temporarily blocked up by short sections of 2-by-4s for this operation. Wiring connections were also completed, except for making final end-connections to related conduit runs from the control panel. These final wiring connections were the only ones made after fixture runs were in their elevated position, and this detail was minor inasmuch as branch circuits had by



EIGHT 2-LAMP SLIMLINE FIXTURES are grouped prior to connection as a single continuous unit, with cartons or wood blocks placed beneath units to prevent possible marring of enamel finish. Wiring of complete unit was effected at floor level with exception of final connection to branch circuit at far end.



CONTINUOUS CHANNEL (foreground), with brackets for connecting rod hangers, was attached along upper centerline of ballast-containing chassis as additional stiffening agent. Rods were then added and folded down along top of fixtures before hoist operation, and lamps were likewise inserted while assembly was still at floor level.

FIVE BLOCK-AND-TACKLE RIGS were spaced along the 64-ft fixture assembly in order to raise it into mounting position with minimum bending, strain or distortion. With five men coordinating their pulling efforts, this installation method proved completely satisfactory. Eight such runs were installed on this job.

that time been installed on an end-wall of the market for that purpose.

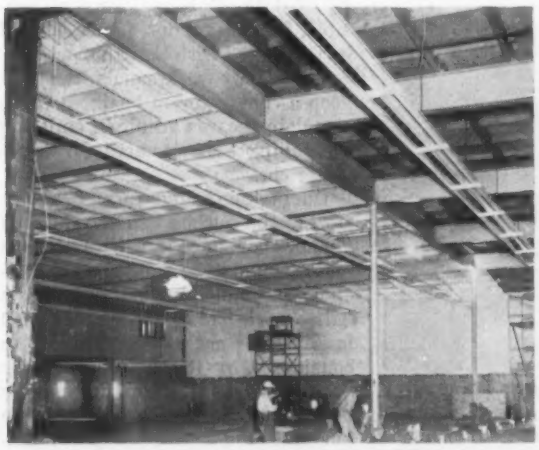
When fixtures were assembled thus, each run was additionally stiffened by installation of a continuous channel along the top center of the fixture chassis. And, at points above the center of each fixture, a swivel clamp was secured to the channel for the attachment of a rod hanger.

These rods were also pre-secured to the clamps, then were folded flat along the top of the fixtures so that, when the unit was finally raised to the desired height, it was a fast operation to swing rods upwards into vertical positions and to attach them to beam roof purlins. Attachment of rod-eyes was by means of through-bolts, corresponding holes in purlins being accurately spotted after fixture runs had been leveled, then quickly effected with a portable electric drill. These final connecting and drilling operations were performed from atop a lightweight aluminum scaffold.

As indicated, the raising of the 64-ft runs was accomplished by temporarily attaching pulley sheaves to main roof beams, then securing the hooks of the related block-and-tackle rigs to the fixture run.

Since five such pulley points were available, spans between adjacent suspension points were not excessive and, with a man stationed at each pulling rope, the units were raised into place without undue bending, strain or distortion.

By pre-assembling the units at floor level, workers had unrestricted freedom of movement with complete safety. Time spent atop the scaffold was minimized and this, in turn, boosted safety still further. It also eliminated the necessity of raising components as separate items, and for providing space for tools and fittings on the platform.



SLOTTED CONSTRUCTION OF FIXTURES permits upward lighting component to illuminate ceiling, thereby minimizing brightness ratio between lamps, reflective surfaces and white-painted ceiling. Although installation was relatively modest in scope, use of pre-assembly techniques and floor-based operations contributed noticeable plus-values.

WORK ATOP MOBILE SCAFFOLD was minimized by pre-assembly approach, with elevated routines consisting only of boring holes in timber purlins with electric drill, inserting bolts through hanger eyes and these holes, spinning holding nuts into place and completing end-of-run electrical connection to pre-installed conduit risers on end wall of market.

PART II

Bidding Doesn't Have To Be Guesswork

Basic bookkeeping system records provide information which may mean the difference between bidding and not bidding, success and failure.

By Rowan C. Brooks,
President, Rapid Electric Service (Professional Estimating), Glendale, Calif.

IN THE event that an already-established contracting company decides to change its basic system of bookkeeping, these proposed changes should be considered thoroughly before putting them into effect. This means that:

1. Exact procedures to be followed for handling sales, production, purchasing, accounting and estimating should be pre-determined in detail.

2. A logical flow of information should be planned in order to automatically schedule and trigger necessary actions in their correct sequence.

3. Types of paperwork and layout of forms should be decided upon so that essential information will be recorded accurately and completely, and that persons responsible for further actions will be automatically prompted.

Then, after establishing such procedures, they should be adhered to consistently.

The Transitional Period

The period of transition from an old to a new system is a period of vulnerability to sabotage, for normal resistance to change may be a subconscious deterrent to complete acceptance by key personnel. For that reason, constant vigilance is recommended.

After working out all details related to a new system of bookkeeping and obtaining necessary new forms, a date of transition should be established. After that date, all *jobs in progress* should remain under the old system until completed or until they may be temporarily interrupted and invoiced. All *new* work started after the date of transition, however, should be handled completely on the new system.

Since it is acknowledged that one "can lose sight of the forest by being too close to the trees," a long-established firm often can profit by the services of an outside consultant who can dispassionately review and analyze methods already in use, then can design and implement completely new methods without facing the spectre of precedence.

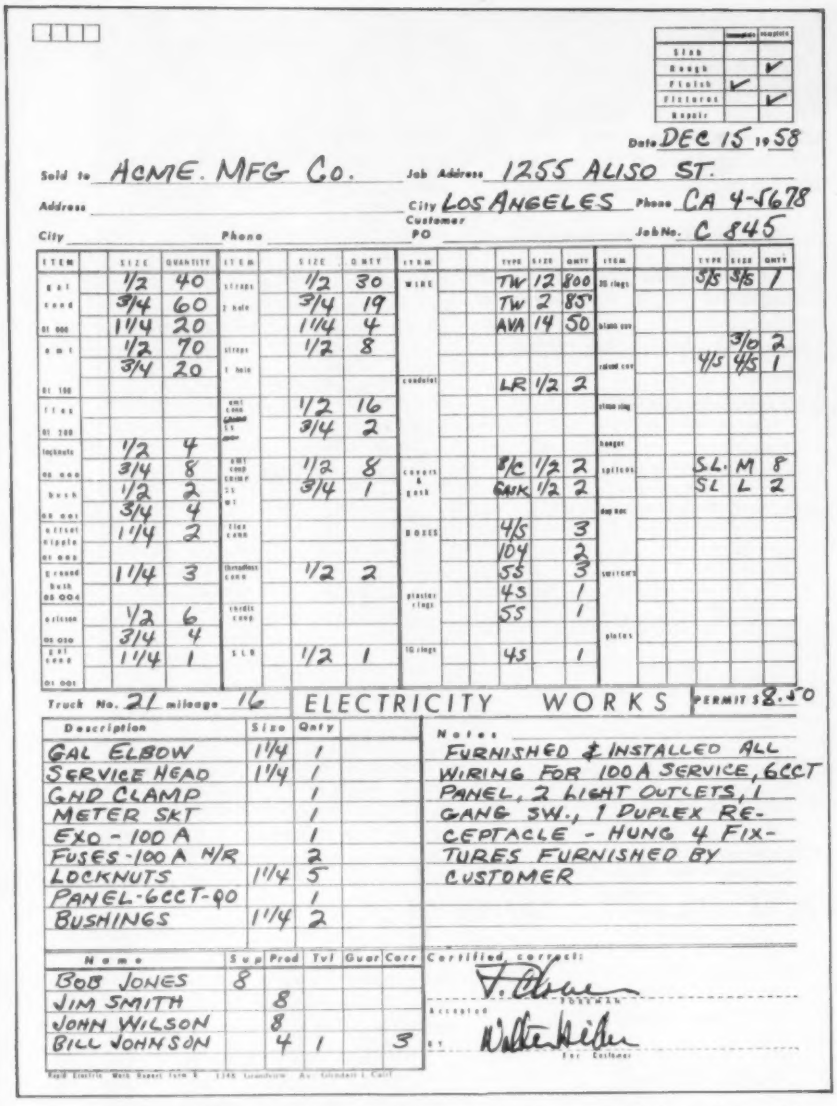
Selection of forms to be used requires considerable care, for although many stock forms are available on the general market, only a few completely meet the requirements of an electrical contracting organization.

ESTIMATING DEVICES, such as the manually-operated Dial-A-Price drum-type unit here pictured, provide rapid, reliable checks on manual accuracy. Relatively simple in design and modest in cost, this device can be rotated to indicate unit prices related to a wide range of items or quantities of materials used in electrical work.

In considering this detail it should be remembered that a form should be easy to use and understand; there must be room for all information required, but information not directly related to cost analysis should be omitted, and time required to make necessary entries should not be excessive. Yet the importance of work reports, proposals, contracts, orders for extra work and so forth should not be minimized, for any or all of these forms could be decisive arguments in settling disputes or supporting claims for subsequent payments.

Forms to be filled out in the field, of course, should be printed on card stock for durability, and writing should be held to the minimum consistent with completeness and clarity of data. But employees responsible for filling out forms should be impressed with their importance, for the finest workmanship will not keep a contractor in business if incomplete records result in omitting the billing of customers for legitimate charges.

During one of our former "recessions," the author had the dubious "honor" of working with a firm which, due to the failure of electricians to completely record materials being used, had to absorb a $15,000 loss. While not catastrophic when considered by itself, this loss was "the straw that broke the camel's back," contributing to failure of the business and loss of jobs for employees. This was another case where no forms were used in the field and where the owner, relying on memory, forgot many "minor" items related to true overhead.



Slab — complete ✓
Rough — complete ✓
Finish — complete ✓
Fixtures — complete ✓
Repair

Date DEC 15 1958

Sold to ACME. MFG Co. Job Address 1255 ALISO ST.
Address — City LOS ANGELES Phone CA 4-5678
City — Phone — Customer PO — Job No. C 845

ITEM	SIZE	QUANTITY	ITEM	SIZE	QNTY	ITEM	TYPE	SIZE	QNTY	ITEM	TYPE	SIZE	QNTY
EMT	1/2	40	STRAPS	1/2	30	WIRE	TW	12	800	3D rings	3/5	3/5	1
cond	3/4	60	2 hole	3/4	19		TW	2	85	plaster ring			
OT BOX	1 1/4	20		1 1/4	4		AVA	14	50				
one	1/2	70	straps	1/2	8							3/0	2
	3/4	20	1 hole							ceiling cov	4/5	4/5	1
OT TEE						conduit	LR	1/2	2				
ffs ex			EMT cond Coupling	1/2	16					plaster ring			
OT ELL			ST cond	3/4	2								
locknuts	1/2	4								hanger			
OS and	3/4	8	EMT cond COUPLING	1/2	8	connectors & bush	S/C	1/2	2	splices	S.L.	M	8
bush	1/2	2	ST cond	3/4	1		GWK	1/2	2		SL	L	2
OS and	3/4	4								duplex			
offset nipple	1 1/4	2	Flex cond			BOXES	4/S		3				
OT and							104		2				
greased bush OS and	1 1/4	3	Threadless cond	1/2	2		55		3	switches			
						plaster rings	4S		1				
orisson	1/2	6	Quick cond				5S		1				
OS and	3/4	4								plates			
EMT cond	1 1/4	1	SLB	1/2	1	10 rings	4S		1				
OT and													

Truck No. 21 mileage 16 — ELECTRICITY WORKS — PERMIT $8.50

Description	Size	Qnty
GAL ELBOW	1 1/4	1
SERVICE HEAD	1 1/4	1
GND CLAMP		1
METER SKT		1
EXO - 100 A		1
FUSES - 100 A N/R		2
LOCKNUTS	1 1/4	5
PANEL-6CCT-QO		1
BUSHINGS	1 1/4	2

Notes: FURNISHED & INSTALLED ALL WIRING FOR 100A SERVICE, 6CCT PANEL, 2 LIGHT OUTLETS, 1 GANG SW., 1 DUPLEX RECEPTACLE - HUNG 4 FIXTURES FURNISHED BY CUSTOMER

Name	Sup	Prod	Tvl	Guar	Corr
BOB JONES	8				
JIM SMITH		8			
JOHN WILSON		8			
BILL JOHNSON		4	1		3

Certified correct: F. Brown Foreman
Accepted by: Walter Heller For Customer

SIMPLE WORK SHEETS can be devised for listing all materials used on a job, all labor units, trucking mileage, fees for permits and so on. Nothing should be left to memory, for good workmanship cannot keep a contractor solvent if incomplete itemizing results in the omission of legitimate charges to the customer.

Good tools in themselves do not assure good work, yet it follows that a competent electrician will do a better job with good tools than without them. In like manner, use of forms will not insure success in administering a business, yet use of proper forms can well mean the difference between profit and involuntary donations of services to customers. Occasionally we hear a small contractor comment that his organization isn't large enough to support a superstructure of competent management, yet even the smallest firm can improve its efficiency by properly processing available data.

A point mentioned in Part I of this discussion referred to the preparation of preliminary job surveys. This is an exceedingly important step, since these surveys provide the only accurate source of determining what scope of work (which we are now rejecting), is actually available to us. These surveys also furnish a record of *why* each job was either bid or declined. And, on jobs which *were* bid, it provides a guide that indicates where procedures in bid-preparation could have been improved. In larger firms it also serves as a guide for take-off men by calling to their attention specific items noted by the individual who made the initial survey.

To Bid or Not to Bid

The information which the surveying individual should have when considering a job is amazing in its scope. For, to act with intelligence, he should first be able to answer such questions as:

1. How many man-days of supervisory labor do we have available during the period that this job can normally be expected to be in progress?
2. What is the availability of journeyman labor during this period?
3. What other requirements during this period will be demanded by contracts now-on-hand or expected, and what will our "call work" be?
4. Considering all work now in process or expected, how much capital is available for this project?
5. What has been our average profit from this type of work, and from this particular customer?
6. What are the requirements for tools and equipment during this period and how will the requirements of this job affect them?

Will we have to purchase tools and equipment surplus to our normal needs?

7. What is the normal progress rate of this type of job, and what is this customer's normal progress rate?
8. What, if any, will be the effect of the work load from this job on our general office operation when all other jobs for the period are considered?
9. How good is the customer's credit, and how promptly can we expect payment?
10. How will any "suspended payments" affect our overall financial picture?

Many contractors have found themselves in real trouble because they believed they knew the answers to these questions, then found that they were wrong. In many cases these contractors would blame the nature of the business, but proper use of information which they could have had would have prevented the error.

Final decision of whether or not to bid requires more than superficial knowledge of mechanical and gen-

eral economic factors. Particularly, it requires judgment and courage to say *no* to a prospective customer who has a job just a little too big in scope or a little too low in margin. Such judgment and courage can exist only when it is backed by considerable knowledge, plus confidence in the accuracy of that knowledge.

Having once decided to bid, another group of questions arise. And, before a final price can be determined, it is necessary to ascertain (1) the cost of materials, (2) cost of labor, (3) other expenses involved directly with the job, (4) cost of overhead, (5) guarantee cost, (6) interest on capital, (7) probable error in estimate, (8) profit necessary, and (9) how much should be allowed for losses from bad debts.

For the average contractor, the safest way to apportion overhead is to apply it to each gross cost on a percentage basis. To get this figure, (1) determine total overhead expenses for a given period, (2) predict total labor and material costs for the period, then (3) divide total overhead by total labor and materials to arrive at a percentage.

This percentage must be added to every bid as a definite expense item to determine the actual cost of performing that work. It also must be considered in establishing selling prices on all T-M work. In general, this percentage of mark-up for overhead varies from a low of around 25% to a high of over 50%.

For most contractors, this figure should be recomputed every three months in order to compensate for errors in predicting sales. Three months is a good period because, during a 3-month interval, there generally will be a sufficient amount of preliminary, rough and finish work to reflect a proper balance in a company's operations.

Although overhead will remain fairly constant within certain fields of endeavor, it is important that all overhead items be included, such as owners' wages, taxes, rent, general advertising, insurance and the like. Some of these items might possibly be overlooked simply because they were not actually payable during the period being considered.

Sales prediction is a different matter for, in this instance, we must literally estimate our expected sales. If our estimate is too high we will not cover our overhead expenses. And, if it is too low, the effect may be to raise overhead costs so high that sales may be driven lower. Either way means loss of money. At any rate all sales for the period will be affected. Here again, we need accurate and complete information of the past to predict the probable future.

Sales Projection

A fairly reliable method of projecting sales is the 3-way method shown below. This makes three estimates of sales, then averages them.

1.—a) Average sales, by quarters, for the past 12 months $_____

b) Average percentage of year's sales represented by the quarter in question for the past 5 years, times 4 _____%

c) Estimate No. 1 of sales (for the quarter) (Multiply a times b) $_____

2.—d) Known work to be done in quarter $_____

e) Average call-work in this quarter for the past 4 years $_____

f) Estimate of additional contract work to be done in the quarter $_____

g) Estimate No. 2 of sales (on a quarterly basis) (Add d, e and f) $_____

3.—h) Average percentage-of-increase from year-to-year for this quarter over past 4 years _____%

i) Sales for same quarter last year . . . . . $_____

j) Estimate No. 3 of sales (for the quarter) (Multiply h times i and add to j) $_____

k) Final estimate of sales (Average of c, g and j) $_____

For the computation of average direct costs of these sales, take the averages for the preceding quarter and for the same quarter in the preceding year. From this a valid overhead percentage for the period in question can be computed.

It is very seldom that one sees a provision for guarantee in a bid, yet it is a real cost and can be calculated just as closely as the amount of materials. Guarantee represents a potential liability that can put a relatively large firm out of business unless provisions have been made to cover this expense. Proper administrative methods can give the contractor this answer. We feel that a provision for guarantee should be included in the cost of every job, and that a reserve be established as an insurance fund for this purpose. Even such a minor error as improperly connecting electrical controls can quickly eliminate the profit on $1000 of work, and a loose neutral in a large fluorescent lighting installation can cost thousands of dollars in labor and materials.

Tool and equipment requirements are frequently overlooked. For jobs within the *normal level* of operation, this is a part of general overhead, but, during temporary periods of increased volume, it becomes important that jobs support the purchase or lease of additional equipment required just at that time.

Questions of Overhead

Finding the cost of materials, labor and other direct job expenses is the responsibility of the take-off man or estimator. These costs can be determined from a study of the job plans and specifications, plus a knowledge of labor factors existing in a particular firm. Overhead, however, is a more complex problem. We know that general accounting statements tabulate total overhead for a given period, but each firm must select the best method for applying this information to its own estimating procedures, according to the specific nature of its own operations and experiences.

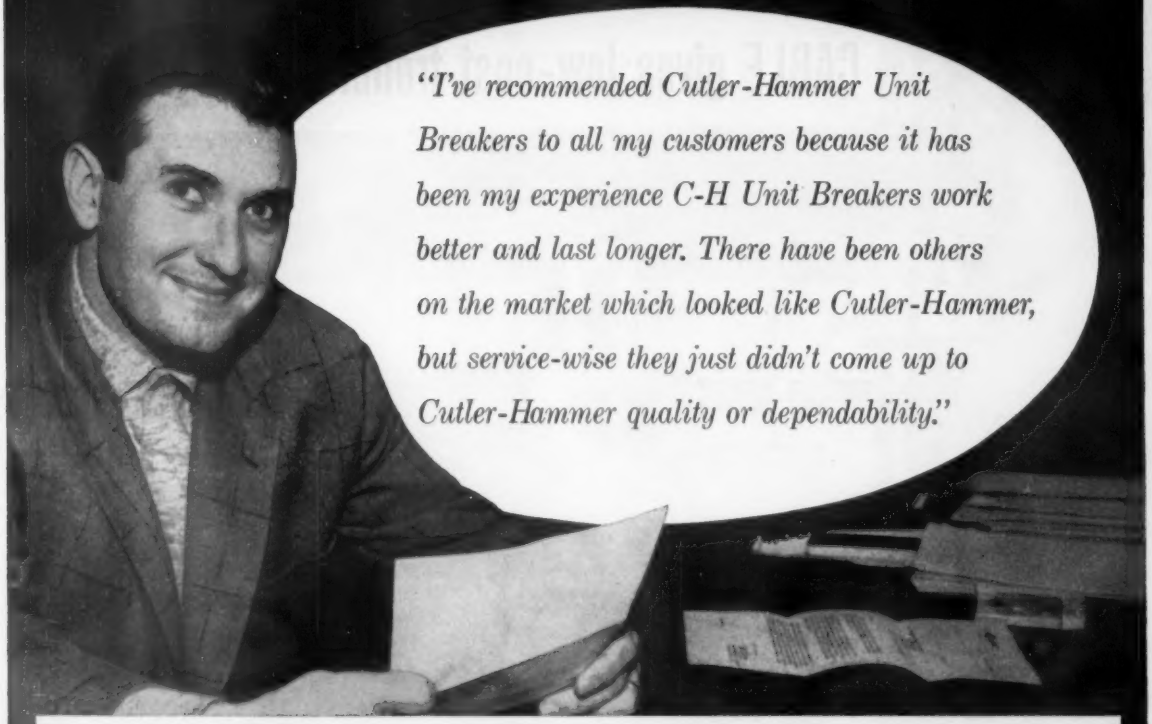
Profit (money left over after all expenses have been paid, including management wages and capital return) is the hardest of all items to compute. The time that a job will be in progress, the risks on the job, taxes on profit, the speed of payment and many other vague factors enter into profit determination. The more accurate the data on which the figures are based, the smaller the profit need be, but no job should be quoted without an expected profit.

Most jobs will not affect overhead materially when considered by themselves. Yet unusually long or comparatively large jobs, or *series* of smaller jobs, always contain the possibility that the amount of work involved, added to that already required by office personnel, will require overtime work or additional help. When bidding this type of work, care must be taken to include such additional expenses as a job cost.

Capital return is also frequently ignored in making estimates. Each job involves an investment of

(Continued on page 132)

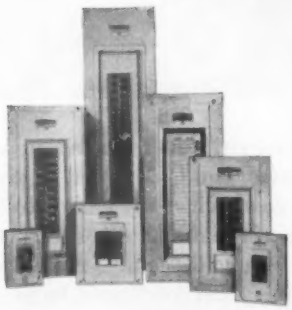
Says: Dick Perry, Perry Electric Co., Flint, Michigan



"I've recommended Cutler-Hammer Unit Breakers to all my customers because it has been my experience C-H Unit Breakers work better and last longer. There have been others on the market which looked like Cutler-Hammer, but service-wise they just didn't come up to Cutler-Hammer quality or dependability."

Thousands of Contractors use C-H Unit Breakers

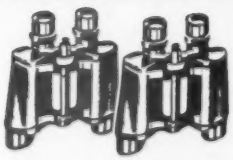
KNOW THE FACTS!



You won't lose profits on service complaints, you won't have unhappy customers, if you buy circuit breakers on performance, *not* on claims. That's what thousands of profit-minded contractors will tell you about C-H Unit Breakers.

C-H breaker performance pays off the same way on large as well as small jobs. Prominent housing projects across America are C-H Unit Breaker equipped, to the satisfaction of builders, contractors and home owners.

For customer satisfaction and full, steady profit, performance points to Cutler-Hammer as your choice in breakers, and 568 Authorized Cutler-Hammer Distributors will agree with you on that choice!



There's a difference . . .
Are you missing it?

When you buy on performance, *not* on looks and claims, the difference between binoculars or circuit breakers is plain to see. Successful contractors, thousands of them, find that the performance of C-H Breakers amounts to an extra "edge" that insures customer satisfaction and betters their business. Get that edge for yourself . . . standardize on Cutler-Hammer. See your nearby Authorized Cutler-Hammer Distributor or write for the new selection guide, *Handi-Log*, Pub. EN100-R-241. Cutler-Hammer Inc., Milwaukee 1, Wisconsin.

CUTLER-HAMMER CONTROL C-H

CUTLER-HAMMER

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Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation.

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Protected by a Trioprene sheath, Triangle's special neoprene compound, RR Cable is flexible, lightweight and tough. It has good aging and heat resisting properties, and is designed to give long-time trouble-free service. It's easier to handle, splice and terminate than metallic sheathed cable. Its first cost is less, and it requires neither conduit nor ductwork under most conditions. In addition to direct burial, RR is also suitable for aerial and duct installations.

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NEW BRUNSWICK, NEW JERSEY

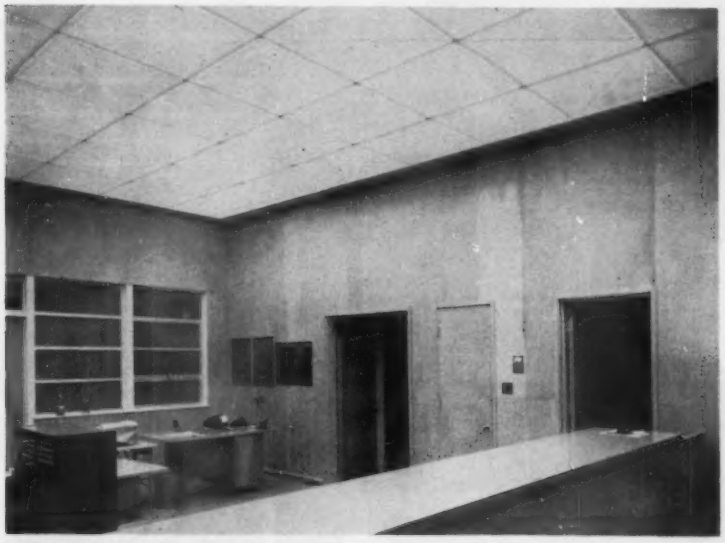
"It MUST Be Right!"

Innovations In Design Highlight Conventional School Lighting Plan

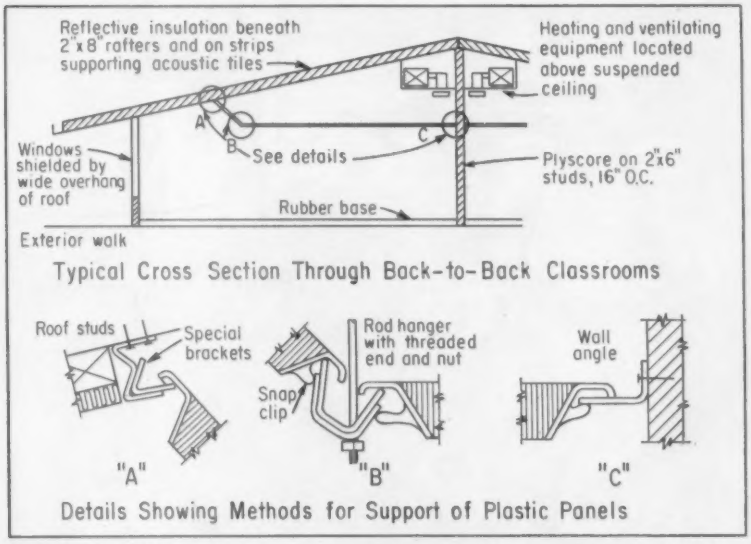
LIGHTING

Since most municipal school boards are restricted by tight building budgets, they generally are receptive to good construction ideas and lighting plans carrying modest price tags. That certainly was the case when the Lincoln High School in Stockton, Calif., was erected last fall, for lighting recommendations provided for 50 footcandles of wide-area low-brightness illumination at a moderate cost, and civic authorities were quick to approve the design.

Basically, the installation involved the use of 3- by 3-ft plastic panels having a simple indented pattern that promoted artistic interest as well as structural stability. Collectively, the panel areas added up to 90,000 sq ft, and they were top-lighted by continuous rows of white slimline lamps operating at 277 volts and wired to permit dual circuiting and 2-level switch control.



SQUARE PANELS forming the suspended luminous ceiling are slightly patterned for interest and rigidity and are top-lighted by continuous rows of slimline lamps operating at 277 volts and dual-circuited to permit 2-level switching control. Connected load is 365-kva.



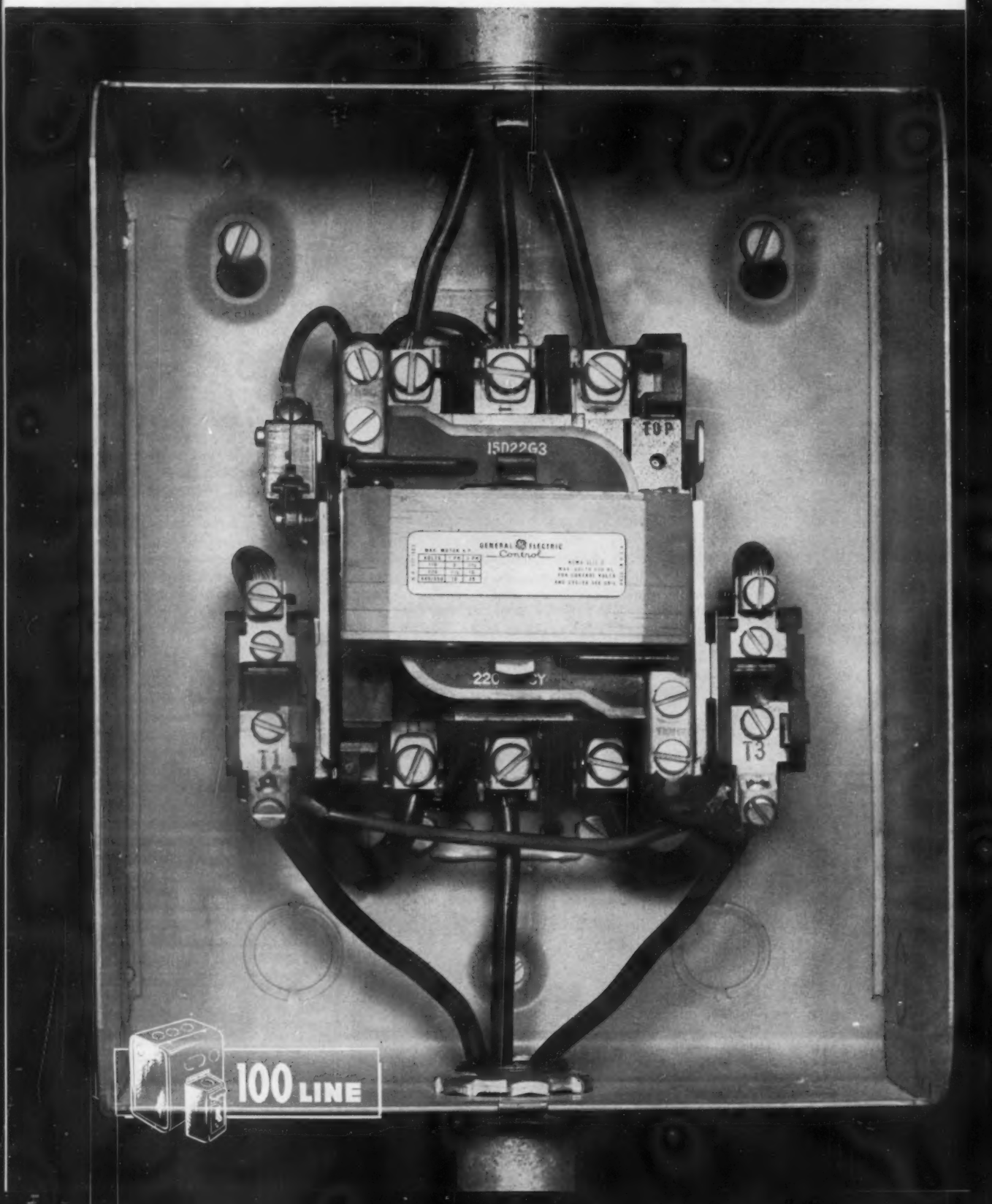
CEILING SLOPES UPWARD near window walls, giving illusion of greater height and permitting full-height glass areas. Wide overhang of roof eliminates shadows and glare from direct daylight. Suspension of luminous panels is by means of rod hangers, angles and special clips.

This rather conventional plan, however, had the added features of several design innovations. For example, since classrooms were positioned back-to-back with a sloping roof extending far out over exterior side walkways, the suspended ceilings were carried horizontally for about three-fifths the distance from inside walls to window lines; then they were sloped upwards to meet the slant of the roof which in these exterior sections were undersurfaced by acoustical tiling. This installation detail somewhat lessened the extent of the luminous ceilings, yet it was felt that desks adjacent to window walls would have the advantage of reflected daylight; that the outer upsweep of ceilings would permit the use of full-height windows and create an illusion of greater overall ceiling height; and that the upward slant of the panels would direct sufficient illumination outwards to adequately compensate for reduced daylighting on cloudy days. Daylighting, moreover, would be rendered practically glareless by the wide overhang of the roof, for this feature would eliminate direct sky-brightness as well as highlights and shadows on glass surfaces.

Another innovation was the use of double-sided aluminum insulation bats on undersides of roof joists in those areas above luminous ceiling panels. This feature had the advantage of double reflection, keeping heat out during summer months, and reflecting both heat and light downwards when either of these services was in use.

Space between the slanting roof and the suspended ceilings, of course, provided ample room for locating (and concealing) all related mechanical equipment, heating ducts and hot-air circulation passages. And, to facilitate this latter service, ceiling panels were edged with continuous slots through which the warm air could filter downwards into the various study and administrative rooms of the school.

14% SMALLER, 10% MORE WIRING ROOM—



THE RADICALLY NEW GENERAL ELECTRIC SIZE 2 MAGNETIC STARTERS ARE...

EASY TO INSTALL

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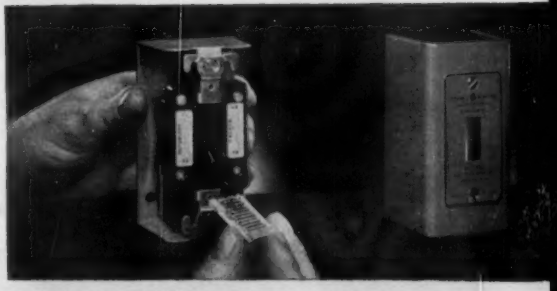
STRAIGHT-THROUGH WIRING—With G.E.'s new Size 2 starter, all line terminals are at the top and all load terminals are at the bottom. Straight-through wiring and new pressure-type terminals save you time because no wires need be bent or looped. You can do all wiring from the front—where it's easy to see, easy to reach.

10% MORE WIRING ROOM—Even though the Size 2 starter features a 14% size reduction, you still get more actual wiring room—about 10% more than with former starter models. Additionally, you get even more accessibility because of the wrap-around cover. All you need do to remove the enclosure cover is press the spring-clip latch.

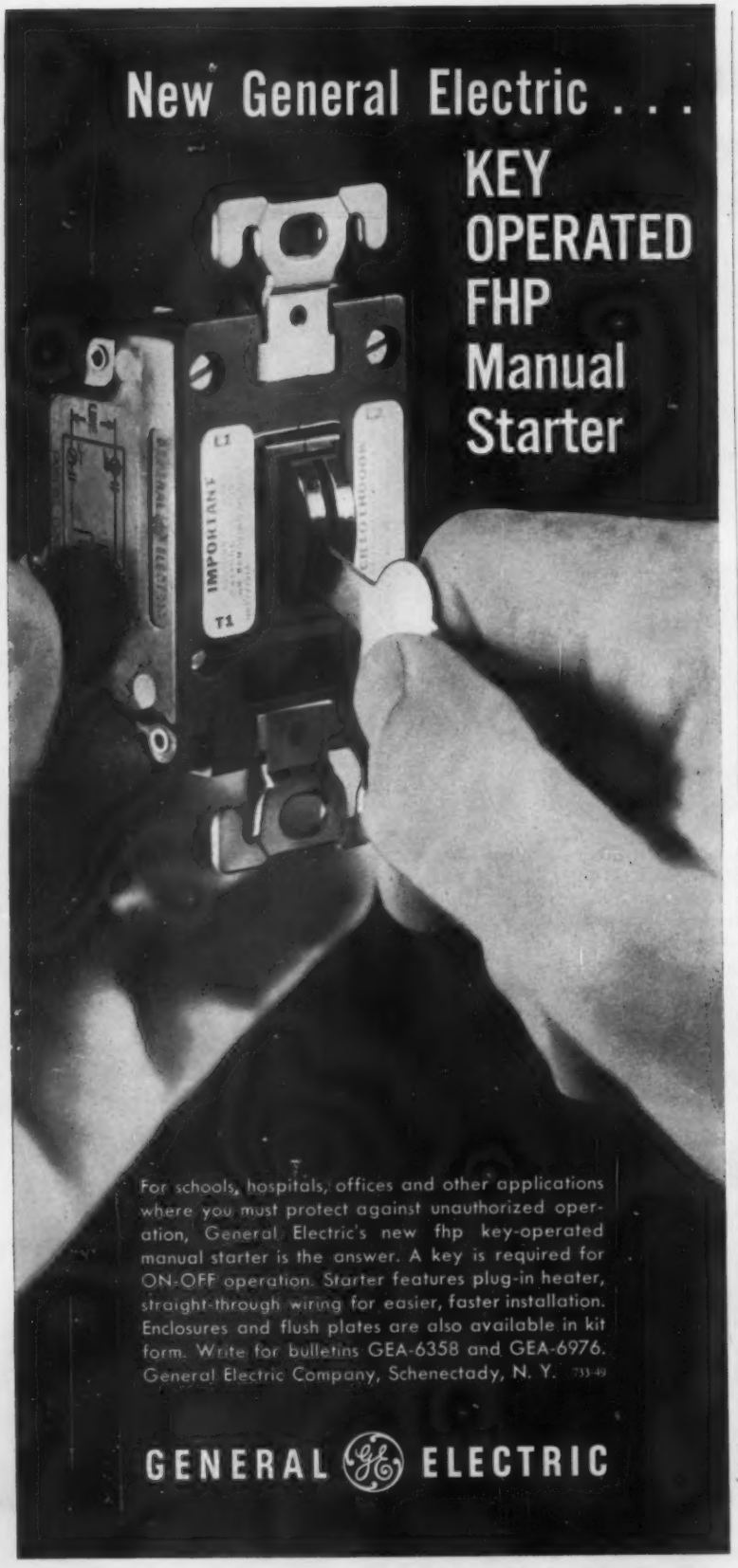
CALL YOUR NEARBY G-E Apparatus Distributor or write Section 733-47, General Electric Co., Schenectady, N. Y. (Ask for GEA-6611.)

GENERAL ELECTRIC

EASIER WIRING is possible because of 10% more wiring space in the enclosure and easily removed wrap-around enclosure cover.



NEW FHP MANUAL STARTER, which is now available in key-operated forms, features an exclusive plug-in heater. (Ask for GEA-6358.)


New General Electric . . .
KEY OPERATED FHP Manual Starter
IMPORTANT
L1
T1
For schools, hospitals, offices and other applications where you must protect against unauthorized operation, General Electric's new fhp key-operated manual starter is the answer. A key is required for ON-OFF operation. Starter features plug-in heater, straight-through wiring for easier, faster installation. Enclosures and flush plates are also available in kit form. Write for bulletins GEA-6358 and GEA-6976. General Electric Company, Schenectady, N. Y. 733-49
GENERAL ELECTRIC

As noted by the accompanying sketch, plastic panels were supported simply by rod hangers, wall bracket angles, ceiling clips and accessory fittings. As a result, panels were installed merely by snapping them into position, while their removal for relamping and cleaning routines was equally simplified.

In its complete extent, this Benjamin lighting installation represents a 365-kva electric load and it fully achieves its objectives of providing effective, efficient, economical contemporary-styled lighting of good quality and in adequate quantity for proper low-glare illumination of desks and tables.

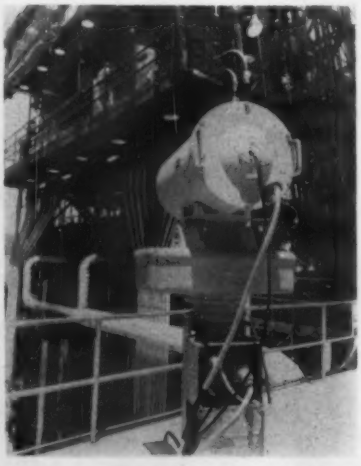
Design of the lighting plan was by architect Dana D. Corrough, while the actual installation was by the Collins Electrical Co., of Stockton.

Closed-Circuit TV Monitors Atlas Tests

COMMUNICATION

With increasing frequency we note that important industrial operations, performed in high-hazard or inaccessible areas, are being monitored by closed-circuit television cameras. This permits technicians, engineers or scientists to closely study critical actions and reactions from vantage points that otherwise would be unattainable, impractical or downright foolhardy.

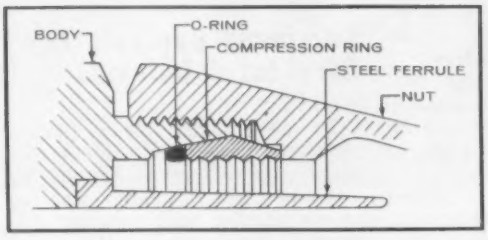
Take for example the static test-firing of Atlas guided missiles at Convair's astronautics center in Sycamore Canyon, Calif.



RUGGED TV CAMERA, mounted on rocket engine test stand at Sycamore Canyon, Calif., is remotely controlled from distant blockhouse in order to permit close-up study of firing reactions via closed-circuit monitor screens.

2½", 3" and 4" sizes

NEW IDEAL VAP-OIL-TITE CONNECTORS



Positive Internal O-Ring Seal

Drawing shows how the internal neoprene O-ring is compressed by the nut tightening on the connector body. Compression ring is forced against O-ring, which in turn is forced against the internal tapered surface of the recess. This causes the O-ring to compress into a firm triangular shaped seal—*nothing can get through!*

The *only* completely reusable connector for use with liquid tight flexible metallic conduit

- holds firmly in locked position—without pull out
- extra-long nut prevents conduit separation due to normal flexing or vibration
- long thread on connector body makes easy starting for assembly
- double positive seal—exterior and interior neoprene 0-rings, meet JIC standards
- beveled split-ring, compressed by nut into tapered body, grips conduit and compresses it against grounding ferrule
- internal ferrule on connector body provides positive ground of conduit
- assembles quickly, easily—and all parts can be reused over and over again
- made of rugged, durable malleable iron

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REFERRED TO AS BABY SITTERS, television units provide engineers and scientists with unexcelled vantage point, although control center is located some 400 ft distant from test stand. While this application is unusual in its dramatic role, it emphasizes TV's potential in many other fields of industry.

There, 30 minutes before the completion of a "count-down," key personnel leave the test stand and retire to a well-shielded blockhouse located some 400 ft distant. However, through the eyes of four carefully placed television cameras, they can watch every phase of the automatic "feeding" of liquid oxygen into rocket engines, then watch the burst of flame and power which would speed the missile on an intercontinental journey if it were not "tied down" for static testing. To resist the effects of the tough temperature, weather and concussion conditions, the cameras and all related gear are understandably of rugged construction.

Since TV cameras are placed within a few feet of the firing point, every characteristic of combustion is visible at close range (with better than 20-20 vision) on monitor screens. And, since cameras can be tilted and panned, and lens irises can be adjusted remotely from distant control consoles, viewing angles and seeing conditions can be adjusted as the action progresses. In fact, from the safety of the remote blockhouse, technicians can do everything with the cameras that they could accomplish locally and manually.

These special TV cameras, manufactured by the Kin Tel division of Cohu Electronics, San Diego, are appropriately nicknamed "baby sitters," for they are alert and dependable, supervise the "feeding" of the rockets, keep their electronic eyes constantly on their assigned tasks and report all pertinent facts to the "parents." And, by so doing, they are making an important contribution to our national rocket and missile research programs.

This application of closed-circuit TV is admittedly unusual in its dramatic role, yet it effectively illustrates the potential that can be attained by equating television to many other "normal" branches of industry.

Luminous Capitals Top Structural Columns

LIGHTING

In designing exterior portico lighting for a new San Francisco insurance office building, consulting engineer Clyde E. Bentley, working in conjunction with architect Edward B. Page, came up with a novel type of column "collar" illumination that effectively combines functionalism with esthetics.

Collars consist of opal glass cylinders that are held between ornamental lipped copper plates and, since these units in turn are sandwiched between smaller-diameter metallic discs, an illusion of "floating light" is created as capital ornamentation for the massive concrete-and-brick columns that support the building's entrance canopy.

Actually, the weight of the canopy is supported by a series of 3-in. pipe columns which are capped by ¾-in. steel bearing plates. Plates are secured atop pipe sections by continuous bead welds.

As noted in Section C-C of the accompanying sketch, each pipe is encased, from base to collar elevation, by a massive concrete and

NO TROUBLE CALLS WITH PUSHMATIC . . .

bolted connections are standard on every breaker

Trouble calls eat up your profits. But not when you install Pushmatic®—the circuit breaker that prevents overheating and subsequent nuisance tripping. You save costly call-backs and the difference goes right into your pocket. The reason?

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No complicated installation, either. To install a Pushmatic simply tighten the handy captive screw onto the bus bar . . . and there it is, a truly trouble-free connection in seconds . . . and an end to a common cause of nuisance tripping.

Other Pushmatic plusses: Pushbutton convenience and control — quality you can depend on. More than a dozen individual tests are given each and every Pushmatic before packaging. The result is safe, proved performance *every* time. Sell Pushmatic and end trouble calls.

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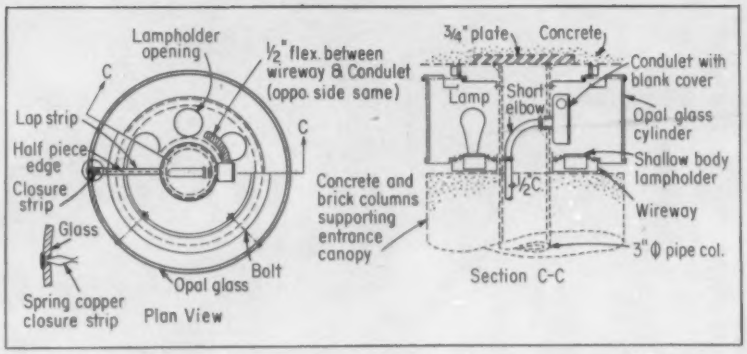


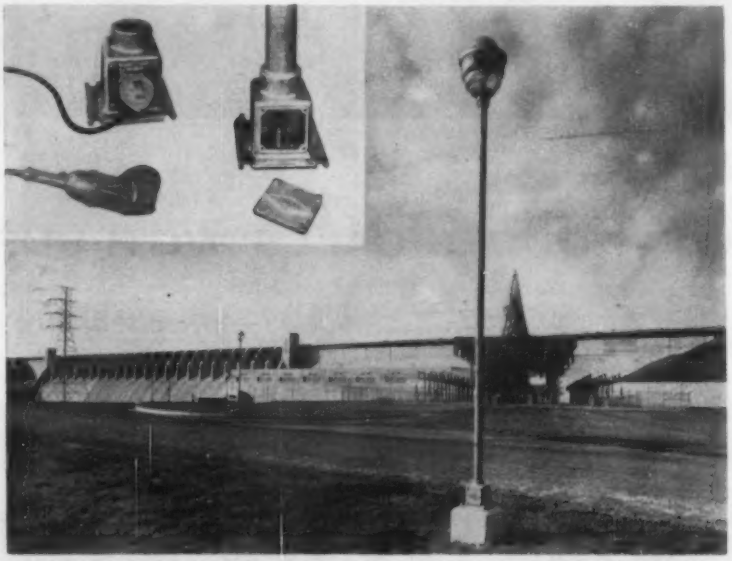
OPAL GLASS CYLINDER surmounts massive concrete and brick column that, in turn, encases portico-supporting pipe section. Glass collar is mounted between lipped copper plates and is illuminated by six inside-frosted PS lamps. Related wiring is carried through Condulet and short elbow to vertical conduit carried inside pipe column.

ornamental brick facing. Also, as noted in the same cross-section, the upper un-encased section of the pipe was drilled to permit passage of a short elbow, that quarter-sweep section connecting an internally-positioned ½-in. branch circuit riser with a blank-cover Condulet secured to the outer shell of the pipe.

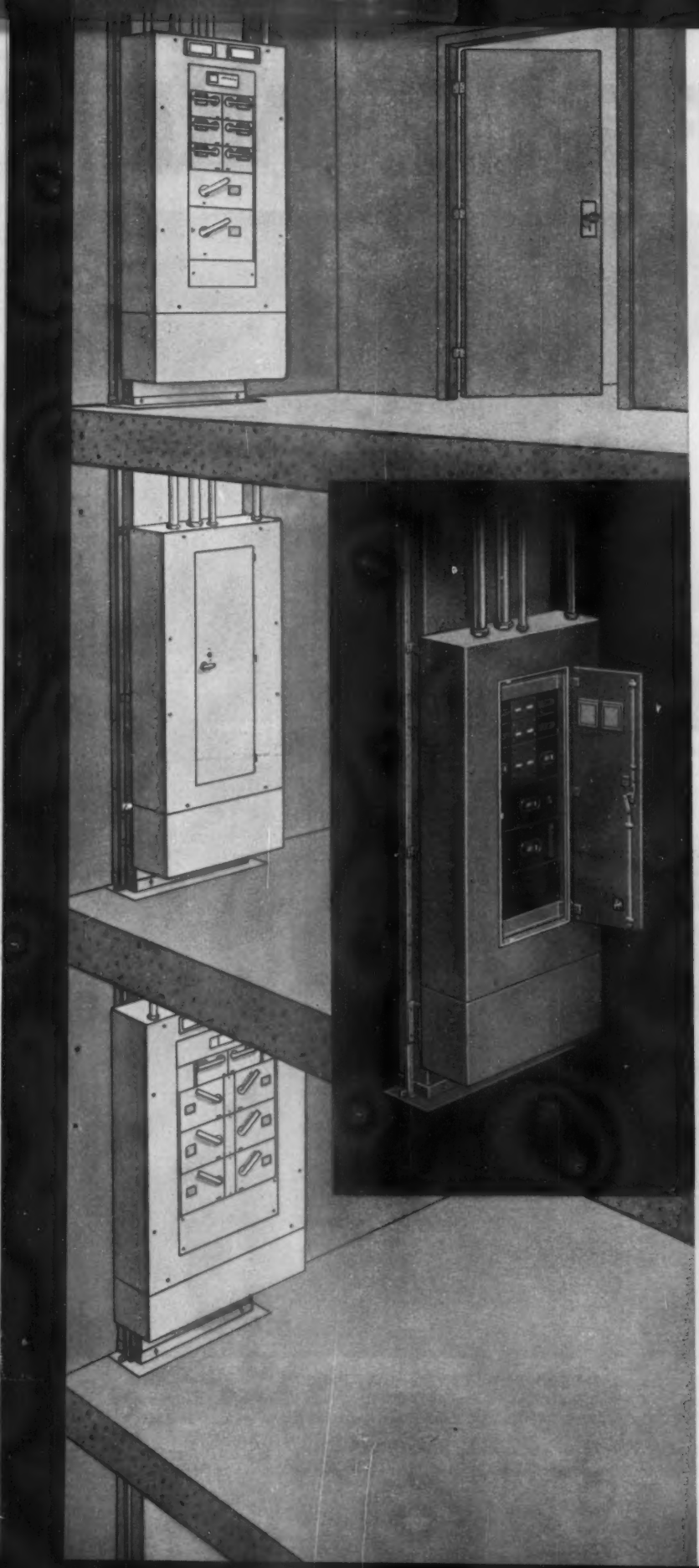
From the Condulet, ½-in. flex connects with a circular special-design wireway that, in turn, supports six equi-spaced shallow-body lampholders. Then, after the fixture was properly lamped, two half-cylinder opal glass sections were placed inside the lip of the lower ornamental copper plate, the two vertical glass junctions were sealed with spring copper closure strips, two semi-circular upper copper lipped sections were lowered over the glass periphery, and these upper metallic sections were finally secured in place by lap-stips and small edge-placed holding bolts.

Branch circuit conduits extend below base of column, then sweep horizontally to enter the building below terrace elevation. Lighting cycles may be controlled either manually from basement, or by astronomical clock mechanism.

Since a close-up night-time photograph of the installation would not indicate these several construction details, the accompanying plan is presented for illustrative purposes.



PIPE-BASE JUNCTION BOXES are used to support and supply lighting poles in parking area and along approach roadway at Clark Hill Dam and powerhouse, built and operated by the U. S. Army Corps of Engineers, on the Savannah River at Clark Hill, South Carolina. Inset shows the malleable iron base, threaded to receive ordinary pipe or conduit upright, with ample space for electrical connections. A cover with plug receptacle is used where required to tap power. The boxes are made by Hope Electrical Products Company, Hillside, N. J.



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the sky with

RISER DUCT BY BULLDOG

Now, there's a *sure* way to provide ample power as many stories high as needed—BullDog's new combination of high-performance Lo-X® duct and integral-mounted power panels.

It's a system where a low, balanced voltage-drop can be predetermined . . . where power loss is minimized . . . and where each duct section has an extra reserved current capacity inherent in its construction.

Other advantages: Power may be tapped off through the compact panels at *any joint* on the duct. Panels bolt easily to the bus bars . . . are available with I-T-E Molded Case Circuit Breakers through 800 amperes or with BullDog's famous Vacu-Break® Switching Units through 600 amperes. Provisions for current-limiting Amp-traps* are optional to protect against dangerous high short circuit currents. And most panels have space for adding future circuits when the need arises.

Install wisely, install the finest. Install Integral Panel—Lo-X Riser Duct by BullDog.

* Chase-Shawmut registered trademark

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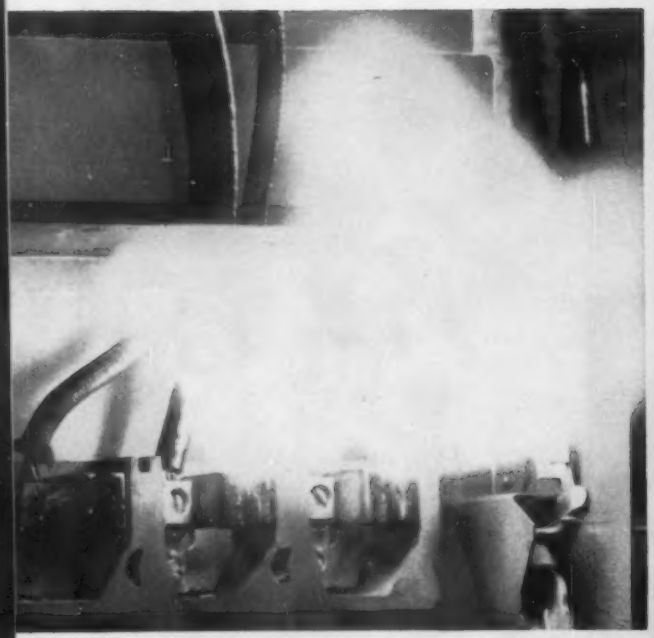
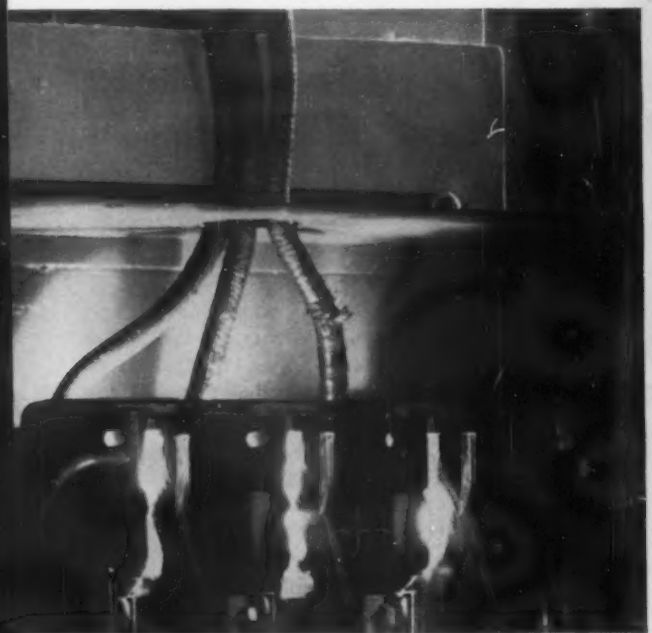
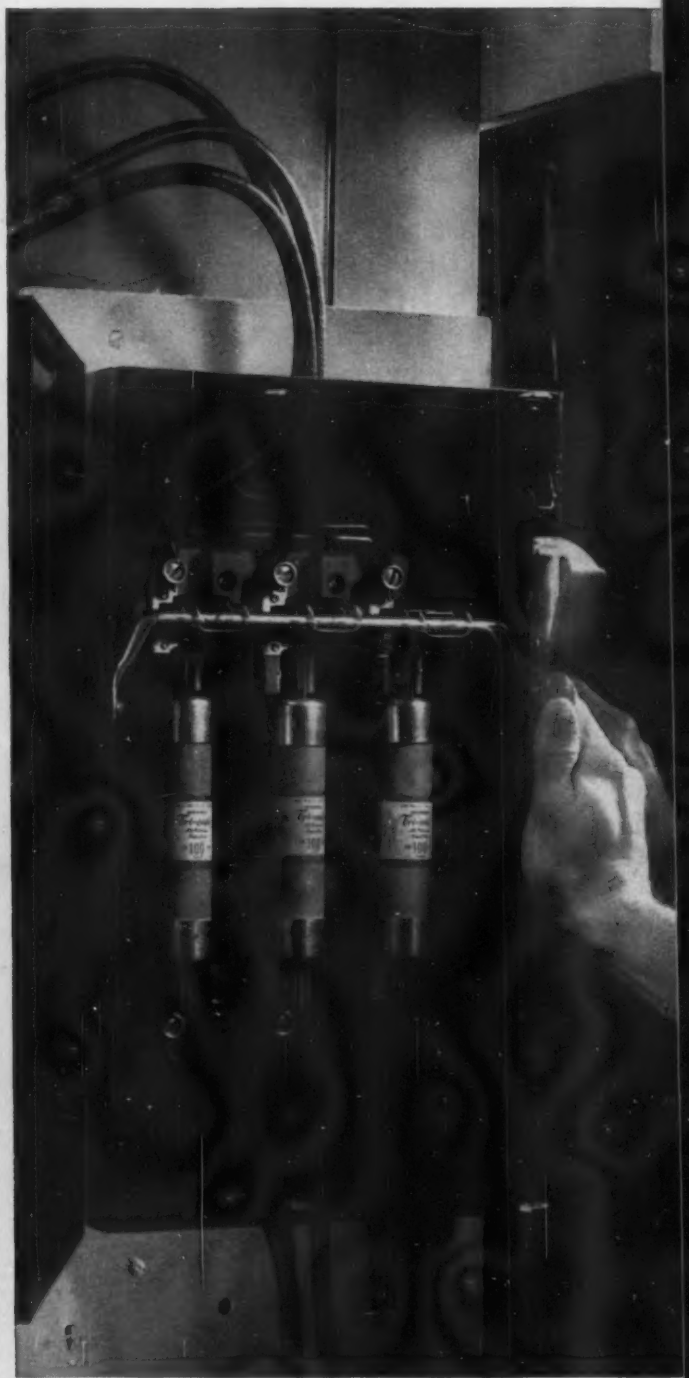
FOR SAFETY'S SAKE:



1. RUINOUS ARC in open knifeblade switch. At moment of "break" a flash explosion occurs. Blades pit, burn, deteriorate. Danger of fire is ever-present in open blade switches.



2. SUBDUED ARC in modified knifeblade switch. Closures or "quenchers" retard arcing slightly, but since blades must ultimately be pulled clear of closures the hazards still exist.



3. MAXIMUM SAFETY found only in BullDog Vacu-Break® Safety Switches. Arcing is confined inside compact Vacu-Break chambers. Arcs are snuffed out before they can cause any serious damage.

Unretouched photographs of the arc in 100-amp 600-volt switches operating under 90-amp 440-volt load with 40% to 50% power factor. All pictures taken at exact instant of "break".

Let's take a good long look at safety in today's safety switches

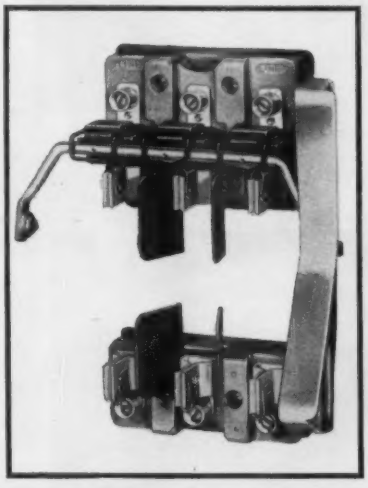
THERE'S A BIG DIFFERENCE in safety switches—a difference between maximum safety and half-way safety . . . low maintenance and excessive maintenance. These differences are quickly apparent when you compare BullDog Vacu-Break® Safety Switches with the other main type—the open knifeblade switch.

BULLDOG discarded the knifeblade design twenty years ago when they engineered the Vacu-Break. It is based on the engineering principle that an arc is the least destructive or dangerous if confined in an arc chamber which limits the oxygen supply . . . actually starves the arc before it can build up. "Explosions" are nonexistent . . . the need for maintenance of contact points is virtually eliminated. Today, only BullDog has the Vacu-Break or anything like it. And it is available at no extra cost on both the Master and Junior types.

OPERATION of the Vacu-Break is simple, sure and safe. A sturdy rod attached to the operating handle is clamped directly to the Vacu-Break heads. When the handle is pushed "Off", this rod literally yanks the heads away from the stationary contacts. *Double "break" action is quick, foolproof.* Unlike knifeblade types, you need not depend on tricky spring and trigger mechanisms. You don't have to open the switch cover and check to see that contact has been broken!

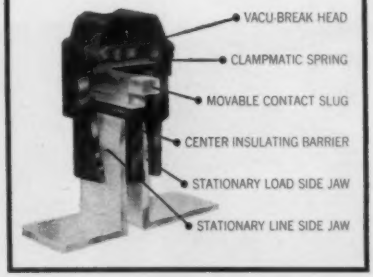
100,000 AMP TEST. BullDog Vacu-Break Safety Switches, when used with current-limiting type Amp-Traps**, will withstand the most severe fault currents. In recent tests standard BullDog switches with Amp-Traps have been subjected to a 100,000 amp short circuit current. *The switches were undamaged!*

THE CLAMPMATIC ASSEMBLY (see the illustration below) is another safety feature of BullDog Vacu-Break Safety Switches. It gives bolt-tight contact in the "On" position, helps accelerate "break" when the switch is pushed "Off". You provide real value, too! Vacu-Break Safety Switches cost no more. Compare!



Vacu-Break heads are connected directly to the switch handle. No toggles or triggers, no tricky springs . . . no danger of switching failure. One of several exclusive BullDog Vacu-Break features that set the performance standards for the industry.

FOR SAFETY'S SAKE BUY VACU-BREAK



Close-up of Vacu-Break head shows movable contact slug inside the compact, oxygen-limiting chamber. Clampmatic assembly assures bolt-tight contact, speeds "break". This combination guarantees positive, safe operation, long switch life.

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* *Vacu-Break and Clampmatic are registered trademarks of the I-T-E Circuit Breaker Company.*

** *Amp-Trap is a registered trademark of the Chase-Shawmut Company.*

Motor Shops

Adjustable Clamps Hold Bearings for Milling

The Electrical Engineering and Equipment Company of Des Moines, Iowa, like many other motor repair shops handling large equipment, does its own relining of split sleeve bearings with Babbitt metal. After the metal has been cast, and hardens in the bearing shell, the lining is milled to specified tolerances and oil ring slots are grooved in the metal with a fly cutter on the milling machine spindle. During this operation, the bearing half must be clamped securely to the milling machine table.

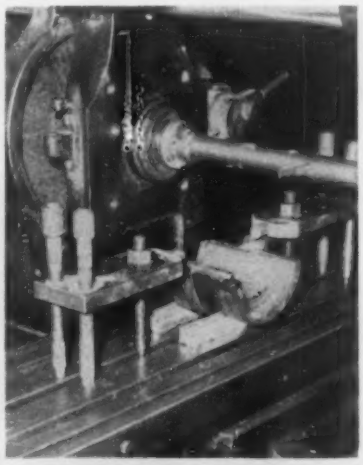
To minimize setup time, EEEC's machinist Frank Easter designed and made a set of adjustable toe-clamps (or strap clamps) to hold a number of different size bearings. Previously, different size blocks had to be cut and used in a variety of combinations to raise the clamps to proper bearing height. This meant a time-consuming setup for each size bearing milled. With the new clamps, setup time is reduced to a matter of minutes for common bearing sizes encountered in the shop.

Main body of the clamp is a block of ¾-in. steel stock, 7¼ ins. long and 3 ins. wide, tapered at the front end to a cylindrical "toe" which rests on top of the bearing shell. At the heel of the block are two tapped holes accommodating ⅝-in. threaded bolts with flat ends and thumb-knurls at the top. These provide about 6 ins. vertical adjustment of the block. A hold-down bolt, extending up through the table slot, passes through a ⅝-in. hole near the toe of the block and has a wrench-tightened nut to apply clamping pressure.

The lined bearing is first seated on wood parallel blocks on the milling machine table. The clamp heel bolts are adjusted until the toe of the block rests on the bearing, with the block in horizontal position. When the clamps are so positioned on both sides of the bearing, the nuts on the hold-down bolts are tightened sufficiently to insure rigid bearing support.

After the bearing has been milled, the hold-down bolts are loosened and the clamps slide back on the table for bearing removal. Another bearing section is positioned, clamped and the process is repeated.

Normally, one set of these clamps covers a fairly wide range of bearing sizes. Readjustment of the threaded heel bolts is necessary only when bearing size changes. If size variation is substantial, longer or shorter hold-down bolts may be required. These bearing clamps have worked exceptionally well and contributed substantially to more efficient milling operations on this type of sleeve bearing in the Electrical Engineering shop.



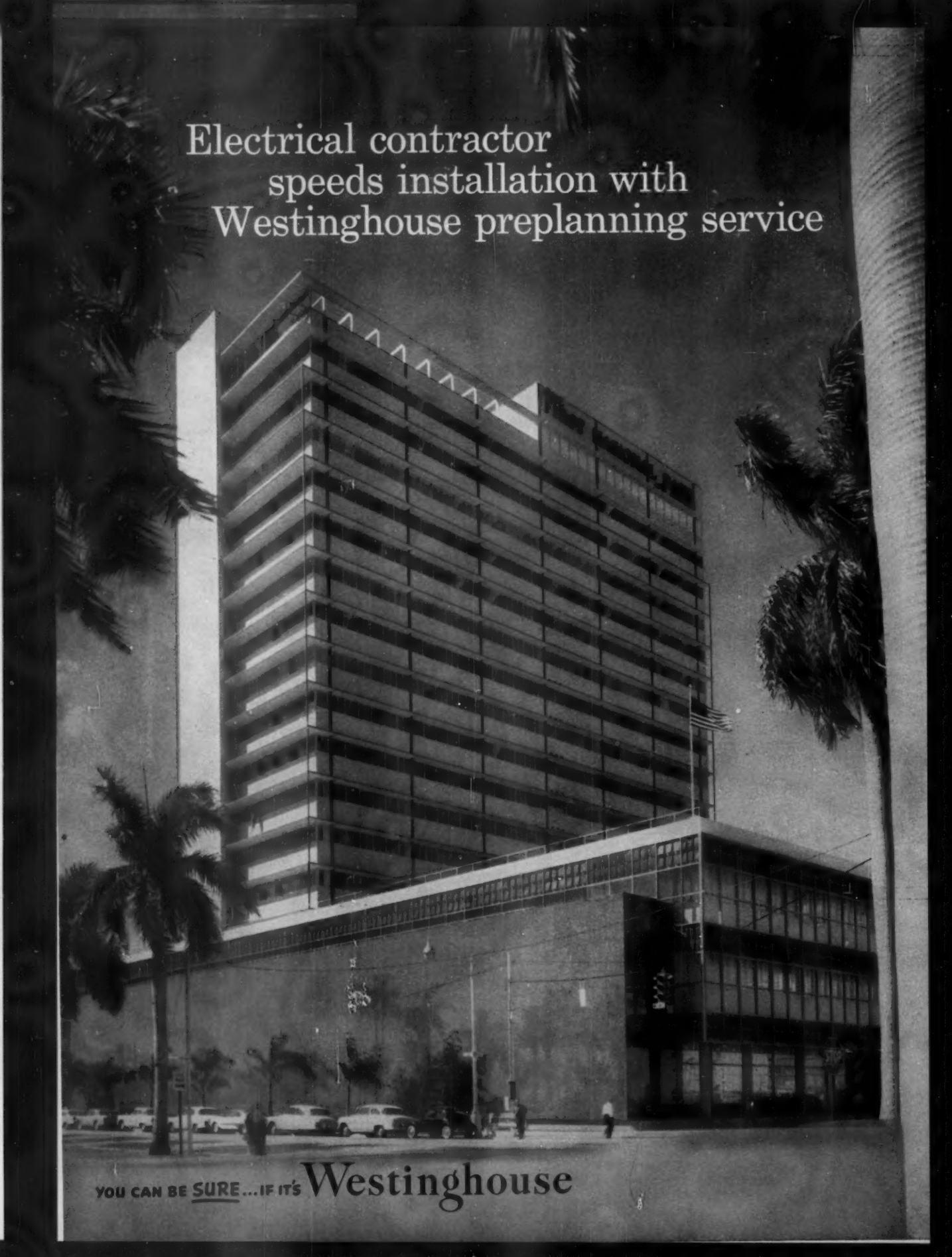
THREADED BOLTS at heel of clamp raise or lower block until cylindrical "toe" rests on bearing shell. Tightening nut on hold-down bolt applies clamping pressure.

ADJUSTABLE CLAMPS hold re-lined bearing securely on milling machine table while fly-cutter forms oil ring slots in Babbitt metal.

Helpful Hints for Greasing Bearings

For lubricating ball bearings, grease has two important advantages over oil: (1) it does not have the same tendency to leak from housings, and (2) it helps seal slight clearances between rotating and stationary parts at shaft openings. However, there are also two disadvantages to grease; for (1) there are so many poor greases on the market that, at high speeds and temperatures, there are often tendencies to separate, dry out, decompose or oxidize, and (2) many attendants have the bad habit of overgreasing.

Needless to say, it is important that dirt does not enter the bearing during the greasing process. The shop-man can prevent this by keeping the cover on the grease can, removing it only for the actual time that grease is being taken from the container, and remembering to lay the housing cover down in a spot and in a manner that will not result in picking up dirt. He should also make certain that the instrument with which he takes grease from the can is perfectly clean. As, for example, he could use a steel blade which could be easily wiped smooth and clean. The maintenance man should likewise remember to wipe off all fittings


Electrical contractor
speeds installation with
Westinghouse preplanning service
YOU CAN BE SURE... IF IT'S Westinghouse

COVER PHOTO: Newest face on the downtown Miami skyline is the 18-story First National Bank Building, headquarters for Florida's largest and Miami's oldest bank. The first three floors are bank offices and facilities and 13 of the 15 floors in tower are rental area.

Proof and Transit Department of bank can clear over 8 million checks, drafts and money orders per month. This operation, which includes 31 electric sorting machines going day and night, demands dependable, uninterrupted electrical service.

Edward Clarke, Project Manager for Rooney-Turner, General Contractors: H. E. Magann, WESCO Manager; and George J. Meinch, Vice President of L. K. Comstock Co., Inc., Electrical Contractors, review blueprints of new bank and commercial office building. Working together on this job, they found that they were able to keep well within the allotted time schedules.

No delay in The First National Bank of Miami job— because contractor, distributor and Westinghouse preplanned the installation

The First National Bank of Miami recently opened for business in the third new building they have occupied in their 56-year history. As before, this move was made necessary because of increased business and growth of their services.

Westinghouse equipment, used in all parts of the building, assures complete and adequate electrical service for highly electrified banking operation and the tenants throughout the building.

The owner, the architect-engineer and the contractor considered construction scheduling as a profit-or-loss factor. They all welcomed the opportunity to work with the Westinghouse distributor and product specialist in careful preplanning of all phases of the electrical installation. Electrical need now and for the future was carefully considered.

Westinghouse products were selected and specified because of system adaptability, quality and ease of installation. The electrical installation went off without a hitch and was completed within the schedule made necessary by other construction, because the electrical contractor and the Westinghouse distributor were able to preplan and schedule deliveries.

The heart of the building's electrical system is a Westinghouse building-type switchboard which protects the circuits distributed at 277/480 volts. Three parallel runs of Westinghouse bus duct serve as main feeders in a vertical-rise design. On each floor, electrical closets house Westinghouse dry-type transformers—for step-down to 120/208 volts—and distribution through Westinghouse panelboards. *(continued)*

YOU CAN BE **SURE**...IF IT'S

Westinghouse

S *Over 250 Pages Westinghouse Data in Sweet's Construction File.*

George Meinch shows H. E. Magann and Edward Clarke Westinghouse lighting panelboards concealed behind hinged wall in ultramodern bank cafeteria. Panelboard on left is Type NLAB, 120/208-volt, 3-phase, 4-wire unit; other is Type NH1B, 277/480-volt.

Charles W. Butsch, Westinghouse product specialist, points out Westinghouse bus duct advantages to prospective tenant. Low-impedance bus duct connects incoming power to Westinghouse switchboard. Space-saving Westinghouse DT-3, 45-kva, dry-type transformer (foreground) is rated at 480-120/208 volts. Main disconnect safety switches are Type CAF, 100- and 200-amp.

continued . . . Electrical contractor—
Westinghouse speed installation

Successful contractors have found that selection of all-Westinghouse equipment, plus localized service, greatly increases installation efficiency. Westinghouse can help with any phase of your electrical planning and construction. Ask the Westinghouse distribution outlet near you, or write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-94121

OWNER: The First National Bank of Miami, Miami, Fla.
ARCHITECT-ENGINEER: Weed-Johnson Assoc., Miami, Fla.
CONSULTING ENGINEER: Norman J. Dignum & Assoc., Miami, Fla.
GENERAL CONTRACTOR: Rooney-Turner (Frank J. Rooney, Inc., Miami, Fla., and Turner Construction Co., New York, N. Y.)
ELECTRICAL CONTRACTOR: L. K. Comstock Co., Inc., Miami, Fla.
WESTINGHOUSE DISTRIBUTOR: Westinghouse Electric Supply Co., Miami, Fla.

Over 250 Pages Westinghouse Data in Sweet's Construction File.

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

William Bausch, Bank's Electrical Supervisor, operates Westinghouse Type NLAB panelboard distributing 120/208 volts throughout the floor. Three vertical runs of 600-amp Life-Line® busway provide 277/480 volts to each electrical closet. Lightweight, wall-mounted dry-type transformers step down distribution voltage from plug-in circuit breaker protective devices to 120/208 volts.

George Meinch, center, explains to Charles C. Gaines, bank staff member (left), and Edward Clarke the dead-front construction of the Westinghouse building-type switchboard which assures complete safety of operation. Note blank sections allowed for future growth.

New Miami bank building gets

13 floors of full power with Westinghouse bus duct

NO APPRECIABLE POWER LOSSES
FROM FLOOR TO FLOOR—CONVENIENT
PLUG-INS MAKE EVERY FLOOR A POWER STATION

"Power closets" on 13 floors of the new First National Bank Building give each floor *full electrical power*—with no appreciable power loss even on the topmost level.

Convenient power-taps make every floor a power station. No splicing or cutting—just plug into the busway—take off full power.

The Westinghouse busway run in this new building is over 550 vertical feet—supplies all of the lighting power demands of the building, plus numerous business machines. These three vertical rises are 600-amp, 277/480-volt, 3-phase, 4-wire.

For the complete story on Westinghouse bus duct for commercial or industrial buildings (low-impedance, plug-in and Life-Line®), contact your nearby Westinghouse sales office. Or write: Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. J-30293

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

YOU CAN DEPEND ON
ROYAL ELECTRIC
PORTABLE CORD

Put it to the test on your work . . . see for yourself why so many leading contractors and maintenance men insist on Portable Cord and Cable with the familiar and trusted Royal brand. You'll find Royal goes all the way to produce easy-working, long-lasting cord . . . with durable, handy packaging for maximum protection and time-saving workability.

Check your cord and cable stocks, today. See your Wholesaler about Royal Rubber, Neoprene, and Plastic-Jacketed Cords . . . Royal Thermostat Cable . . . Royal Machine Tool Wire . . . Royal Lamp and Fixture Wires . . . and Royal "Powr-Kord" Heavy Duty Extensions. Or write for catalogs, giving wholesaler's name.

ROYAL ELECTRIC
...an associate of ITT

ROYAL ELECTRIC CORPORATION • PAWTUCKET R. I.

and nozzles when using a grease gun. And, when housing covers are to be removed, first wipe off all dust and dirt.

It should be emphasized that a ball bearing requires only a *small amount* of grease, so housings should be filled to only a quarter or at most a half of their full capacity. When installing new bearings, the shop or maintenance man should fill the bearing space itself (that is, the sides of the bearing) with grease, but should put relatively little inside the housing itself. In fact, for new bearings, the housing should be preferably filled to not more than a third of its volume.

The immediate effect of excessive grease within a bearing is overheating due to a churning of the lubricant. Under such conditions the grease tends to disintegrate and gradually lose its value as a lubricating medium. This is especially true at high speeds. If the bearings run too hot after a charge of grease, the trouble quite likely could be due to overgreasing. In such cases, the drain plug should be opened while the unit is running in order to permit the excess to work out.

It is impossible to state accurately how frequently a ball bearing should be lubricated, although a good general rule to follow is to add a small amount periodically, watching carefully for evidences of either an excess or a deficiency of grease. Observation of the application will definitely determine the intervals at which greasing is desirable.

Some bearings, of course, require greasing at frequent intervals, although such applications are rare.

GROUP LEADER Mitchel Frye and treasurer-superintendent Joe Keenan discuss a motor rewind job in the shop of Lange Electric Co., Baltimore, Md.

"By installing BERMICO CONDUIT at breakneck speed, we kept project work moving on schedule"

WILLIAM McCABE, Vice-President
Lord Electric Co., Portland, Oregon

Under construction. Lloyd Center, Portland, Oregon, one of the nation's largest metropolitan business-shopping developments, costing an estimated $30,000,000. 20,000 KVA initial power requirement.

"PRIME CONTRACTS for the Lloyd Center were let four months before the electrical contract," pointed out Mr. McCabe, Vice-President and Manager of the Portland office of Lord Electric Co. "By the time we were awarded our contract — the site was ready for the electrical conduit, so we had to move fast.

"Fortunate for us, Bermico was specified. By installing Bermico Conduit at breakneck speed, we kept project work moving on schedule."

Bermico Conduit is a great boon to electrical engineers, contractors and utilities. It is lightweight, easy to handle, simple to cut and assemble. Each 8-foot length is precision engineered, with smooth inside bore to allow easy pull-through without abrasion. Bermico is made from cellulose fibre, impregnated with coal tar pitch. It is extremely resistant to acids, alkalies, heat, water and corrosion — and of high dielectric strength. Use Bermico on *your* next job.

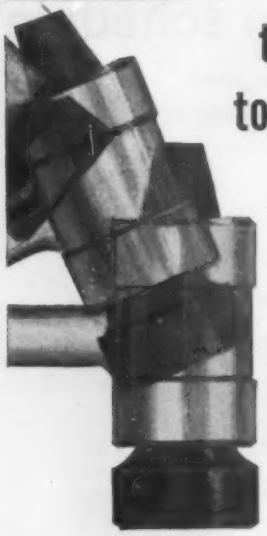
Distributed by WESTINGHOUSE Electric Supply Company and Agent Jobbers. Offices in Principal Cities.

Another quality product of

BROWN QUALITY COMPANY

General Sales Office: 150 Causeway Street, Dept. 1589, Boston 14, Mass. *Mills:* Berlin, N. H.; Corvallis, Oregon

COUNT ON SHURE-SET



the "power-concentration" tool that revolutionizes light fastening!

With Shure-Set's unique "Power Transfer" design, you can drive pins and threaded studs right through light-gauge metal into concrete with a few strokes of a hammer. The hammer-driven Shure-Set light fastening system is ideal for carpenters, plumbers, electricians, builders, and maintenance personnel for quick, reliable fastening into steel, concrete, or building block... no drilling or cartridge required.

Shure-Set supports the fastener until it is driven home . . . no duds, no bent studs or pins, no smashed thumbs. Try Shure-Set and you'll save time, money, and temper while doing a better job. Look for your Shure-Set dealer under "tools" in the yellow pages.

In addition to hammer-in Shure-Set, the versatile Ramset Fastening System includes Ramset powder-actuated method for heavier fastening, and Ringblaster® heavy-duty kiln gun.

OLIN MATHIESON CHEMICAL CORPORATION — Shure-Set™

Ramset Fastening System

WINCHESTER-WESTERN DIVISION • OLIN MATHIESON CHEMICAL CORPORATION
12105-H BEREA ROAD • CLEVELAND 11, OHIO

Others may need renewal of grease only at 6-month, 9-month or even yearly intervals, or perhaps even longer. To determine this interval may take a year or so of checking.

Grease, even when it is a good grade, is subject to deterioration over a long period of time, although this process may be very slow under favorable conditions. In addition, the grease is subject to contamination of dirt, grit, moisture, metallic particles and so on. For these various reasons, an actual cleaning out of the bearing and grease housing is advisable as often as may be necessary.

To clean out a housing, it is best to first remove the bearing, thereby making it possible to wash the bearing and clean the housing independently. The first step is to remove as much old grease as possible, using a rag or brush for this purpose.

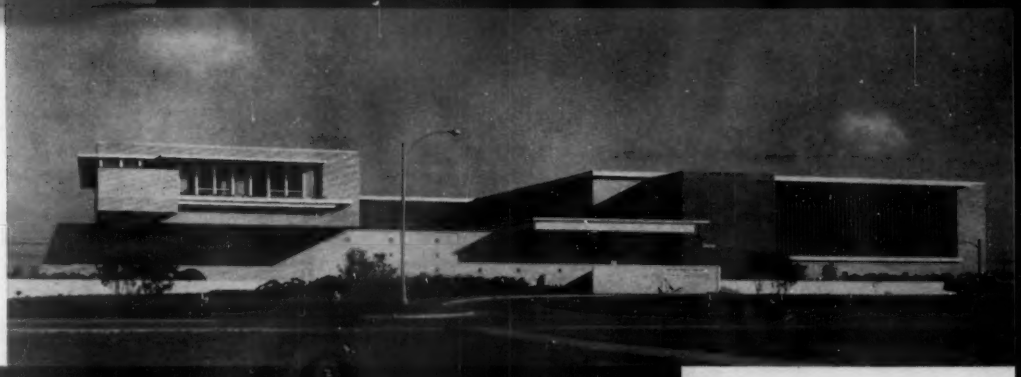
Next, flush out the housing with clean hot (between 110- and 125-degrees F) kerosene, washing out all dirt, grit and foreign matter. Instead of kerosene, sometimes a good grade of carbon tetrachloride or an approved safety solvent is recommended for this job. Before adding fresh grease, be sure to flush out with a light mineral oil of about an SAE No. 10W or its equivalent. This operation will prevent subsequent rusting.

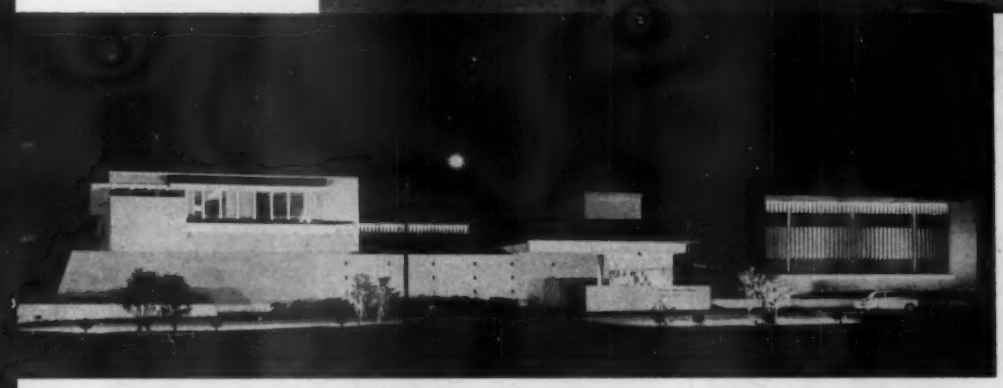
Washing out hardened rancid grease from the bearing is somewhat more difficult, so the following procedure is advised:

(1) Soak bearing in hot kerosene; (2) rotate slowly with air hose; (3) dip bearing in clean kerosene or an approved safety solvent or light oil; (4) again rotate the bearing slowly without the air hose, this time for a period of a few minutes. This loosens the remaining dry grease adhering to races and balls; (5) wash bearing out again in clean kerosene or an approved safety solvent; (6) support inner ring in one hand and turn outer ring slowly by hand. If bearing feels smooth, then repack with clean grease and remount in housing after housing has been thoroughly cleaned out; (7) if, however, bearing still feels rough, soak it for a few minutes in light oil or an approved safety solvent. Then turn the outer ring slowly by hand, exerting a thrust first on one side, then on the other, continuing until the particles of hardened grease are completely loosened. After this, repeat steps 5 and 6 again.

In problems on lubrication, the maintenance and shop man should realize that shaft size and speed

Decorative and security lighting for the Administration Center of Dow Chemical Company's Texas Division is achieved through use of 15 Wide-Lites placed around the building.





Wide-Lite Model F-400-AWB

creative lighting calls for **WIDE-LITE**

Dramatic lighting effects are easily achieved when Wide-Lites are selected as the lighting engineer's basic tool.

Designed especially to enhance the unique characteristics of color-corrected mercury vapor lamps, Wide-Lites bring *new dimension* to decorative lighting. They produce broad patterns which may be overlapped to provide smooth, even coverage without concentric circles, hot spots, or dark shadows to mar the architectural harmony of a building. The patterns are unusually uniform and may be accurately plotted to determine the exact number of units needed to provide any desired illumination level.

Ruggedly constructed from cast aluminum alloy, Wide-Lites are finished in aluminum epoxy paint for corrosion control. All outdoor models are sealed with tempered glass lenses, and relamping is accomplished without disturbing the seal of the lens. Exclusive built-in heat radiating fins limit lamp temperatures to the most efficient range. Sizes range from 100-watt to 1000-watt, and a choice of reflectors is available on all models.

To assist you in planning dramatic decorative lighting effects, Wide-Lite engineers have prepared a unique group of transparencies which read directly in Wide-Lite beam footcandles. Write today for your set . . . and a copy of Catalog 444 which gives information on the complete Wide-Lite line of indoor, outdoor and special application fixtures.

WIDE-LITE.

Manufactured by

WIDE-LITE CORP.

P. O. Box 191 • Houston 1, Texas

IN CANADA: WIDE-LITE DIVISION OF WAKEFIELD LIGHTING, LIMITED • LONDON, CANADA

HOW THE ALUMINUM IN K/W INTERLOCKED ARMOR CABLE SAVES YOU MONEY...SPEEDS YOUR JOB

K/W 3 Conductors Interlocked Armor Cable Spec. 808-S vs. 3 Copper Cdrs. in Steel Conduit
COST AND WEIGHT COMPARISON—1000 FT.

600V RHW 75°C RUBBER 3 Copper Cdrs. in Steel Conduit							600V ALUMINUM INTERLOCKED ARMOR Aluminum Conductors, 90°C, Butyl Insulation						SAVINGS WITH ALUMINUM				
		CONDUIT															
Wire Size	Amps.*	Trade Size In.	O.D. Inches	Area Sq. In.	Total Wt.—Lbs.	Total Cost—$	Wire Size	Amps.**	O.D. Inches	Area Sq. In.	Total Wt.—Lbs.	Total Cost—$	% Bonus Ampacity Alum. over Copper	SAVINGS (1) $	%	Weight Savings Lbs.	Space Savings %
2	115	1¼	1.66	2.17	2,860	903.	1	120	1.44	1.63	850	713.	4.3	190.	27	2,010	25
1	130	1½	1.90	2.82	3,570	1,155.	1/0	135	1.53	1.84	960	806.	3.8	349.	43	2,610	35
1/0	150	2	2.38	4.44	4,660	1,457.	2/0	160	1.63	2.07	1,115	926.	6.7	531.	57	3,545	53
2/0	175	2	2.38	4.44	4,960	1,609.	3/0	180	1.74	2.38	1,285	1,093.	2.9	516.	47	3,675	46
3/0	200	2	2.38	4.44	5,350	1,814.	4/0	205	1.87	2.74	1,550	1,265.	2.5	549.	43	3,800	38
4/0	230	2½	2.88	6.51	7,730	2,508.	250	230	2.04	3.27	1,840	1,522.	0	986.	65	5,890	50
250	255	2½	2.88	6.51	8,190	2,883.	300	255	2.16	3.66	2,080	1,751.	0	1,132.	65	6,110	44
300	285	2½	2.88	6.51	8,700	3,171.	350	285	2.27	4.04	2,325	1,870.	0	1,301.	70	6,375	38
350	310	3	3.50	9.62	10,860	3,752.	400	305	2.37	4.41	2,560	1,998.	–1.6	1,754.	88	8,300	54
400	335	3	3.50	9.62	11,370	4,053.	500	355	2.56	5.14	2,990	2,260.	6.0	1,793.	79	8,380	46
500	380	3	3.50	9.62	12,390	4,748.	600	395	2.79	6.11	3,545	2,615.	3.9	2,133.	82	8,845	36
700	460	3½	4.00	12.57	15,930	6,459.	750	455	3.02	7.16	4,175	3,151.	–1.1	3,308.	105	11,755	43

* Based on 1956 N.E. Code ** 90°C Conductor—40°C Ambient. Note—Comparison of 75°C RHW and 90°C Butyl K/W Spec. 107. Current prices, 4-29-59.
(1) Savings based on increased cost of copper and steel over aluminum cable. Weights and prices for 1000 ft.

1. LESS COST

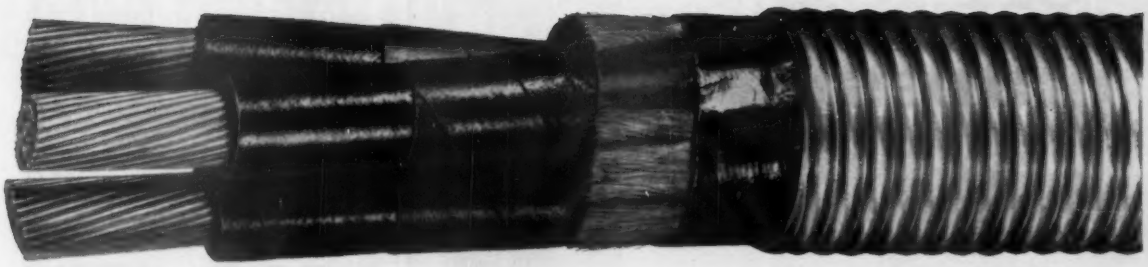
You realize important savings on *materials* with KW Aluminum Interlocked Armor Cable because (1) it gives you greater current-carrying capacity per dollar, (2) the nature of its aluminum armor eliminates costly conduit. Also, you save on *costly labor* because KW's corrosion resistant aluminum armor holds upkeep to a minimum, even in highly corrosive areas.

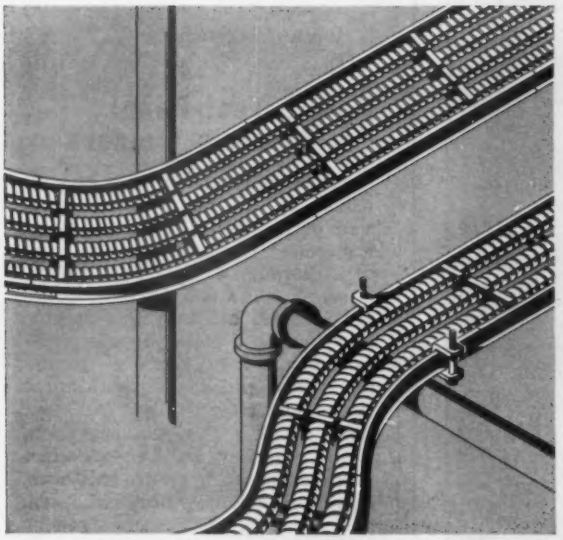
2. LESS WEIGHT

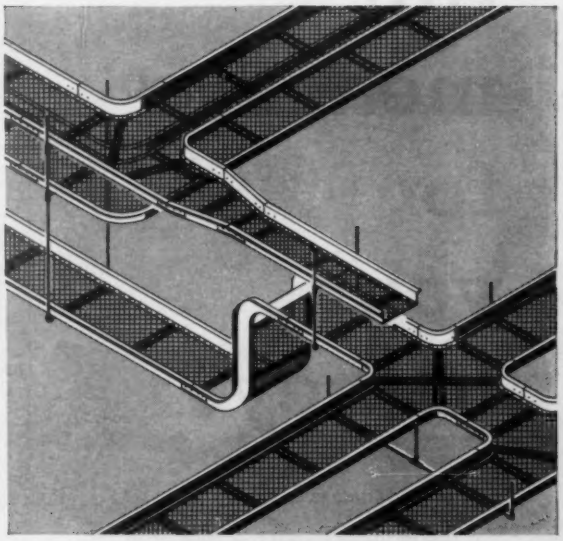
Any interlocked armor weighs far less than heavy, bulky steel conduit. But KW gives you *additional* weight savings because its armor is aluminum—weighing only ⅓ as much as steel or bronze. Moreover, because the conductors are also made of aluminum, they are less than half the weight of copper conductors that carry the same amount of current.

Versatile Use. KW Aluminum Interlocked Armor Cable is the ideal answer for industrial and commercial distribution systems, generator leads and auxiliary cable installations.

For complete information, call the Kaiser Aluminum sales office or KW distributor listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, Calif.







3. FASTER INSTALLATION

The light weight and supreme flexibility of KW Aluminum Interlocked Armor Cable mean easier handling, cut installation time in half. It can easily be bent horizontally or vertically around impeding objects and laid in longer lengths, eliminating the need for frequent splicing. In addition, because its diameter is less than conventional conduit systems, compact KW cable can bring space savings of up to 54%.

4. SPEEDIER MODIFICATIONS

KW Aluminum Interlocked Armor Cable may be laid on readily accessible racks, trays and troughs . . . or hung from a messenger. It is a quick and simple matter to expand KW Interlocked Armor Cable systems to meet increased power requirements which may arise after installation.

KAISER ALUMINUM

"If It Carries Current, KW Carries It!"

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Consult your local TV listing.

CHASE Tapes give you full measure for your money!

Guaranteed footage in every roll is just one of many features in your favor when you buy Chase Friction, Rubber, Plastic, Neoprene and Butyl Tapes. You'll like their lasting tack . . . easy handling qualities . . . high dielectric and tensile strength. Try some soon and see! Order through your wholesaler.

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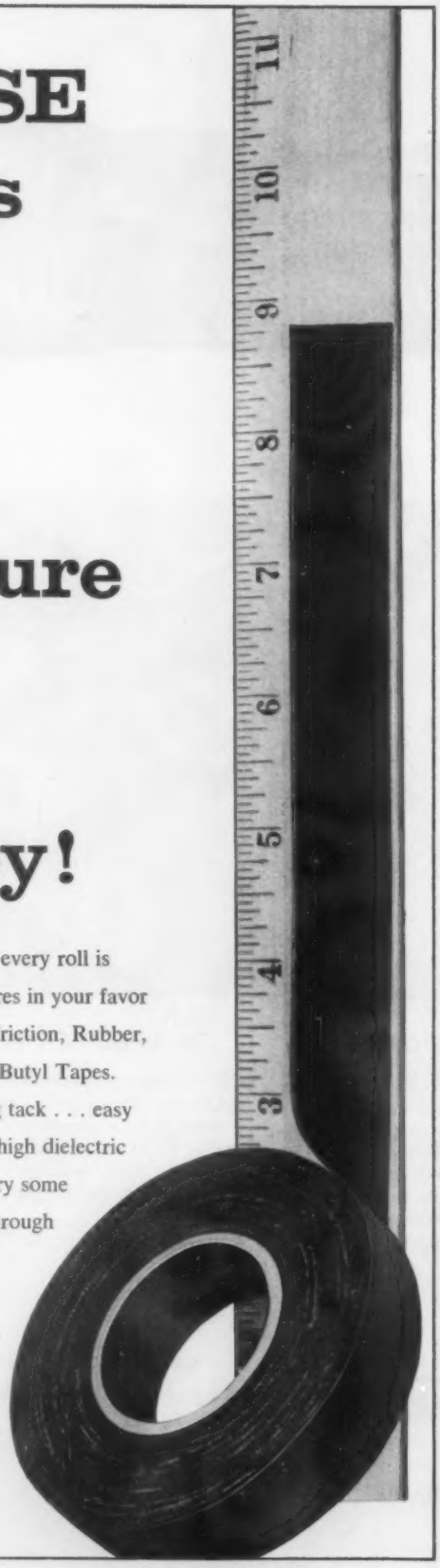


are important factors. In other words, the higher the cage and ball speed, the more necessary it is to pay attention to the quality of the grease, its consistency and periodic renewal of lubricant. In the higher speed ranges, the shop man must be especially careful to see that the bearing is greased at proper intervals and that the proper amount of grease be added.

All bearings must be protected at the shaft openings by means of suitable seals whose purpose is to retain the lubricant and to exclude dirt, grit, water, etc. Seals for retaining grease are necessarily of much simpler design than those intended for retaining oil. When much dirt gets past these seals and mixes with the grease, a decidedly abrasive compound is formed which rapidly wears out the bearing and is difficult to remove.

Mobile Test Panel For Electric Welders

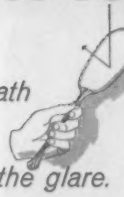
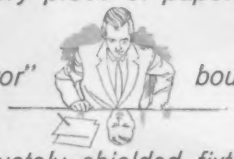
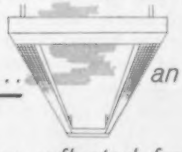
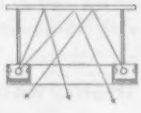
Electric welders checked and repaired in the Des Moines, Iowa, shop of Electrical Engineering and Equipment Company are subjected to a thorough load test before release. Voltage and current values are watched carefully and specific attention is directed to commutation under load conditions—particularly any evidence of sparking at the commutator.

To simplify this test operation, EEEC engineers built a mobile test unit incorporating an arc enclosure, open compartments for test leads, and meter panel. The unit can be rolled anywhere in the shop. If

MOBILE TEST PANEL simplifies load testing of electric welders at Electrical Equipment and Engineering Company's Des Moines shop. Operator keeps eyes on meters as he is about to strike test arc.

A BRILLIANT NEW WAY TO SELL RE-LIGHTING

Give the Mirror Test at a man's desk

Place a mirror directly underneath  *his lighting fixture. Let him look at the reflection for ten seconds* *and notice the glare. While he looks away and rests his eyes* *(they'll need it) you tell him this: every piece of paper,* *ash tray, and even the desk surface itself is a "mirror"*  *bouncing light back into his eyes. Result: people who work under inadequately shielded fixtures suffer a significant loss in visual efficiency.* *Recent research indicates the need for more light and less glare. The new high-capacity fluorescent lamps give the "more."* *When you put them in an ILC fixture you eliminate the glare. ILC means Indirect Luminous Ceiling...*  *an exciting new Seeing System that directs most of the light upwards. It is then reflected from the ceiling*  *as diffused, softened light. Easily-installed ILC in office, drafting room, store or school means a tremendous stride forward in comfort,* *accuracy and efficiency. Want to know more? Ask for a copy of the salesmen's kit which contains a mirror and tells the whole story in simple straightforward language. We'll also send you details of how you can get free mirrors to leave with prospects. Send coupon to* **SILVRAY LIGHTING,** *Inc., makers of*

To Silvray Lighting, Inc., Bound Brook, N.J. Dept. 8E
Send me complete information on your new plan to help us sell the re-lighting market.

NAME_____

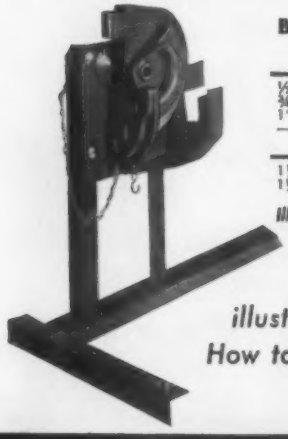
COMPANY_____

ADDRESS_____

LIDSEEN "Chicago" Benders are your Best Buy...

Ask the Electrician who uses one...

He's our best advertisement and your best source for a first hand opinion as to its real value on the job. They are complete machines of all steel construction . . . no loose parts to be misplaced or lost and the only maintenance is an occasional drop of oil. **Lidseen "Chicago" Benders work equally well on Aluminum or Steel Conduit.** You get accurate bends every time and you will marvel at the way it quickly produces precise repeat bends and offsets so important in exposed installations. Remember . . . ask the electrician who is using a "Chicago" Bender; he will tell you its the finest tool available and at a price that is eminently reasonable.



BENDING CIRCLES: INSIDE RADIUS

	No. 1	No. 1T
½" conduit or pipe	2"	EMT 3"
¾" conduit or pipe	4¼"	EMT 4½"
1" conduit or pipe	5¾"	EMT 6½"
	No. 2	**No. 2T**
1¼" conduit or pipe	7¼"	EMT 9½"
1½" conduit or pipe	8¾"	EMT 10½"

Illustrated: No. 1 for bending ½", ¾" and 1" rigid conduit

Write for FREE illustrated Folder on How to Bend Conduit

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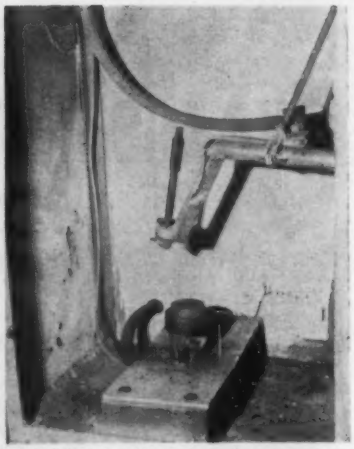
1050 FIRST STREET, HAYESVILLE, NORTH CAROLINA
PHONE HAYESVILLE 2000



INTERIOR of asbestos lined arc compartment showing carbon block electrode at base and adjustable carbon rod on spring-retained, pivoted arm above. Stack pipe exhausts arc fumes from compartment.

necessary, it could be used to test welders in the field.

The basic cabinet is about 20 ins. deep, 24 ins. wide and 37 ins. tall; stands 5½ ins. above the floor on four sturdy industrial casters; is topped by a 24-in. by 20-in. by 4½-in. panel containing two rows of meters. The top row shows generator volts and amperes; the bottom row, exciter volts and amperes. A 2-in. dia. "smoke stack" protrudes some 3 ins. above the panel; extends through the panel to the arc compartment below; acts as an exhaust duct for arc fumes during test.

Most of the cabinet console is occupied by the arc compartment whose sides are lined with asbestos sheet as a heat and fireproofing measure. At the base of this compartment is a 2½-in. dia. carbon block (some shops use a metal block) which extends some 4¾ ins. above the supporting bracket. One of the load test leads is connected to the bottom of this block. The other lead is connected to a spring-retained arm positioned above the block. One end of this arm is equipped with an offset collar which holds an adjustable carbon rod; the other end (insulated handle) extends through the front of the compartment and is pivoted on a pin-bracket mounted on the face of the console.

When making a test, the operator raises this handle (against spring tension) which lowers the carbon rod until an arc is struck. Moving the handle up or down varies arc length (separation between electrodes) as desired. Generator and exciter voltage and amperes can be read directly from the meters as the test progresses.

NATIONAL ELECTRIC DIVISION

No Splits! No High Welds! Easy to Bend and Fish!

SMOOTH BAKED ALUMINUM INTERIOR

ELECTRO-GALVANIZED EXTERIOR

EMT BY NATIONAL ELECTRIC NOW FINEST IN THE INDUSTRY

NEW INDUCTION WELDING *gives smoother seams . . . seams that are actually stronger than the metal itself.*

Continuous Testing Protects Product Quality

1. Rockwell tests for hardness
2. Strength tests for weld and durability
3. Bendability tests to measure workability
4. Torque wrench tests to measure lbs. per sq. inch pressure
5. Expansion tests over mandrel (4 to 6 times per day)
6. Gauge tests to check strip variation

Inquire at your local National Electric Distributor or write now to: *National Electric Division, H. K. Porter Company, Inc., Porter Building, Pittsburgh 19, Pa.*

EASY TO BEND: *High ductility makes possible difficult bends and offsets. Fast, easy fishing.*

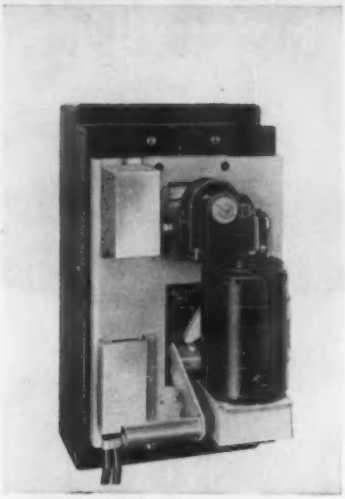
NATIONAL ELECTRIC DIVISION PORTER *H.K.PORTER COMPANY, INC.*

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Copper and Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S. A.; and in Canada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

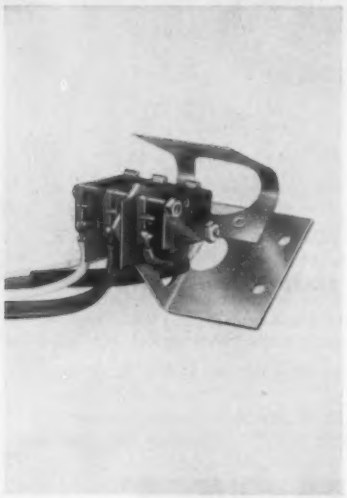
TOUGH APPLICATION OR DESIGN PROBLEMS?

General Electric circuit breaker

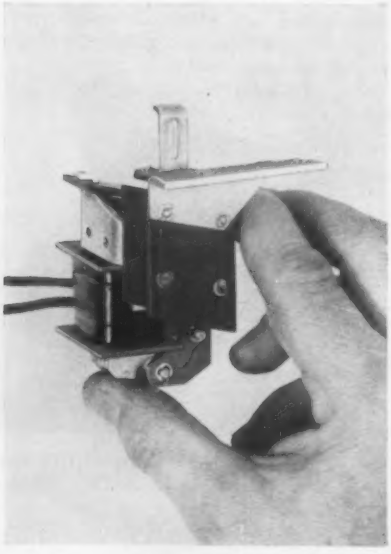
SHUNT TRIP: Opens breaker by remote control, permits pushbutton remote tripping. Used to disconnect power from a remote or centralized point or to interlock with other electrical circuits (AC or DC). Can be actuated by limit switch or relay for automatic feedback control.



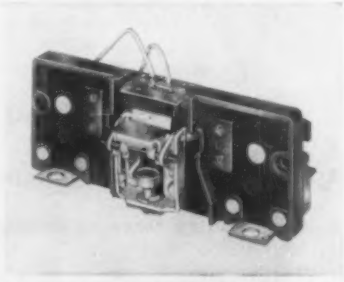
MOTOR-OPERATED MECHANISM: Opens, closes and resets breaker by remote control. Can be used for automatic reclosing or preferred-emergency hook-up by addition of relay. For automated installations, isolated unattended pumping stations, radar systems, etc.



AUXILIARY SWITCH: Operates relay and control circuits at same time as breaker. For remote indication of breaker position (ON or OFF) by means of indicating lights. Can also actuate relays, control related equipment, interlock with other breakers.

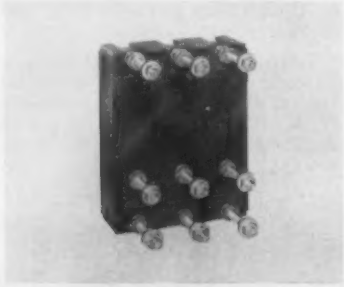


UNDERVOLTAGE RELEASE: Trips instantly when voltage dips. Used to protect motors, elevators, hospital and theatre lights against damage or loss of voltage and to actuate emergency equipment. Voltage must be restored before breaker can be reclosed. No time delay in operation.

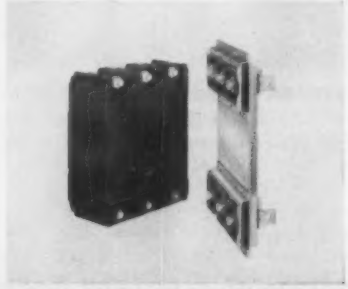


BELL ALARM SWITCH: Signals when breaker trips, protects against unobserved outage, resets automatically.

MECHANICAL INTERLOCK: Prevents two adjacent breakers from being closed in at same time.



CENTER STUDS: Permit use of one breaker and trip unit for double-wound generator or transformer, with full protection.



PLUG-IN SWITCHBOARD MOUNTING BASE ASSEMBLIES: Convert standard G-E breakers to plug-in. May be mounted side by aside.

accessories are the answer!

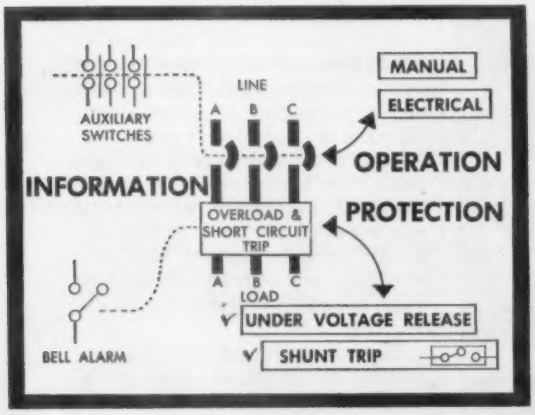
Versatile, convenient, most can be installed in the field

With ever-increasing automation and mechanization, complex control problems need fast solutions — and versatile General Electric circuit breaker accessories cover a wide range of applications to help you solve control problems. They can provide remote closing or opening, lowered voltage protection, overload trip-out indications, automatic reclosing, electrical or mechanical interlocking and primary or sequential operation. (See diagram below.)

For example, if you need to trip a circuit breaker by remote control, the G-E shunt trip is the device you need. It permits push-button remote tripping. In addition to remote control operation, the shunt trip can be used as an electrical interlock with other circuits, either AC or DC. Actuated by a limit switch for automatic feedback control, it is ideal for use in plant safety systems for machine limits, time limits, or any kind of a positive action system.

And you no longer have to wait weeks for delivery of factory-installed accessories. Most General Electric accessories can be field-installed on standard breakers, by your own men, when you need them. Efficient, reliable G-E circuit breakers and accessories answer the growing need for circuit protection, operation and information.

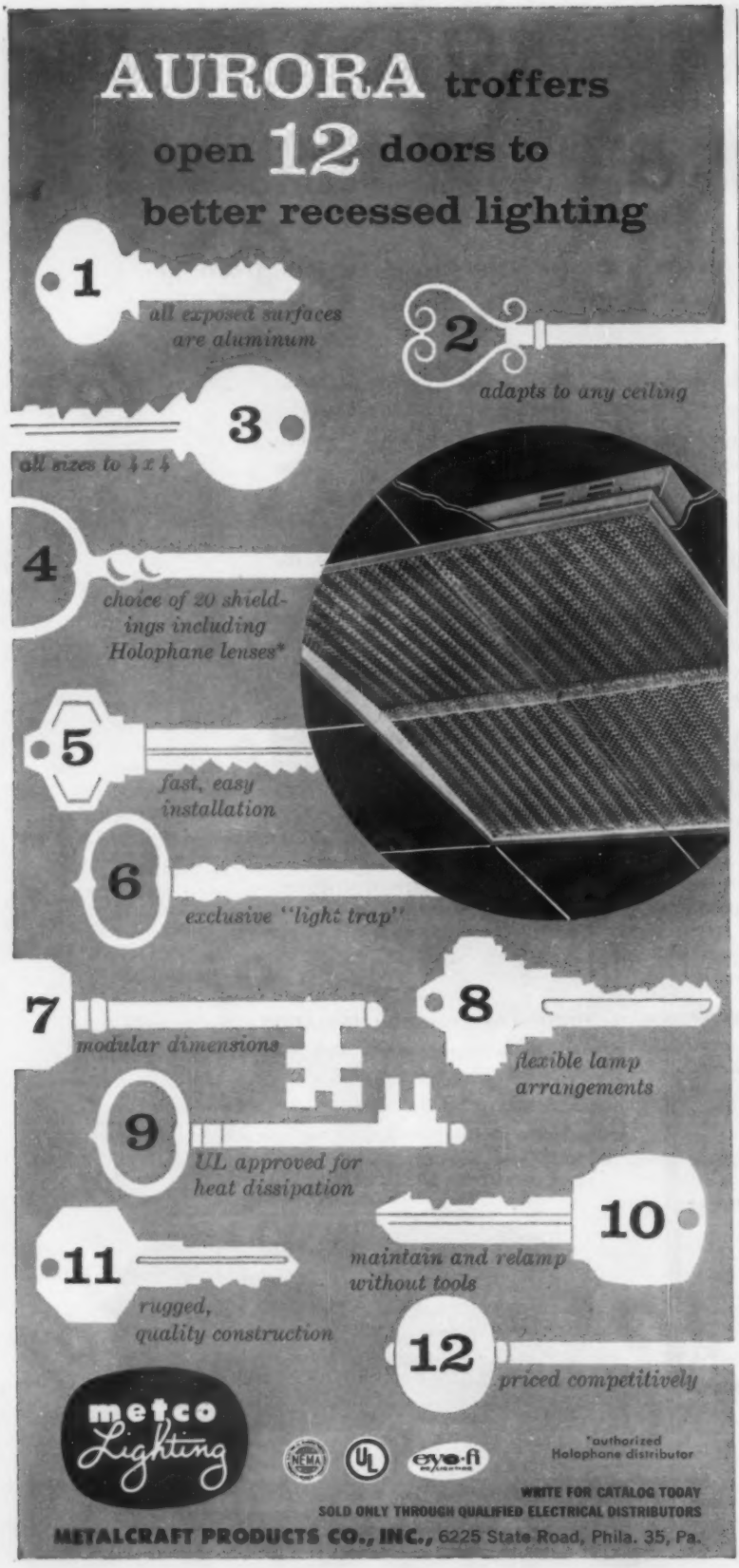
For complete information, see your nearest General Electric distributor, or write Department CBA, General Electric Company, Circuit Protective Devices Department, Plainville, Conn.



PROTECTION, INFORMATION, OPERATION — this example shows how several accessories might work together to give you all 3: Undervoltage device provides low-voltage protection. Auxiliary switch shows you breaker is open. Bell alarm switch tells it has opened on a short or overload. Motor operated mechanism gives you emergency power throw-over or remote operation.

General Electric makes a complete line of molded-case circuit breakers and accessories. 10 to 800 amps — 120 to 600 volts AC, 125 to 250 volts DC.

GENERAL ELECTRIC



BIDDING DOESN'T HAVE TO BE GUESSWORK

[FROM PAGE 100]

capital, and, unless there is a return to cover the earning power of this money, the firm will eventually die. On small jobs this amount may be so minor as to be negligible, but on the total volume of business this becomes a sizable item. A contractor doing a gross business of $100,000 per year will have an average of $12,000 capital tied up in jobs for the entire year. Interest on this tied-up money amounts to almost 1% of the gross business. This is roughly equal to a journeyman's pay for a month.

Errors of Prediction

All predictions contain possibilities for error. If estimating procedures were absolutely consistent, this error would be a constant. But even the most careful, skilled estimator cannot completely avoid pitfalls of engineering mistakes, reproduction variations or slight job changes. As a result, the errors on estimates can range from a minus to a plus percentage. If accurate records have been maintained on all jobs, and these records have been related to the estimates, this average error-range will be known, and can then be considered in making up final cost figures.

Of course, labor units must be adjusted continually in the light of productivity changes, but these adjustments will naturally "lag" the actual changes.

It is apparent that problems of estimating and management go far beyond merely making lists of materials, computing labor and deciding on a desired rate of profit.

To be reasonably sure of having a profit, one must have wide knowledge and information which, until only recently, the small or medium-sized contractor has not been able to obtain, or has been unwilling to make the effort required for its obtainment.

Management of an electrical contracting business is hard work, complex and confusing. Yet it can be simplified by administrative procedures that provide a clearer picture through the medium of proper, complete records. As knowledge and understanding increases, management improves. And, as management improves, profits increase.

Puzzle: Find the Spang Floor Pan! In this unretouched close-up photo, it's barely visible between the man's feet. From a few feet away, it's difficult to spot this access-box covering. Only 1/16" rim and corner and center screws are visible.

(Right inset) Linoleum tile is easily and accurately cut to fit recess in this square Spang Floor Pan design. Center and corner screws hold floor pan and access box plate firmly in place. Square access box provides maximum working area.

1/16" rim makes this SPANG floor pan practically invisible!

New square aluminum alloy recessed pan covers underfloor duct access openings . . . provides smooth, unbroken floor pattern

Now, SPANG offers you another exclusive feature which enhances appearance of the finished building equipped with SPANG Underfloor Duct and SPANG Headerduct electrical raceways . . . the SPANG Floor Pan.

This new square pan, which covers duct access openings, does not present the problem of thick, conspicuous pan rims or circular cuts in the floor. It is constructed of 1/16" stamped aluminum alloy. Floor tile can be quickly and accurately cut to cover it.

The SPANG Floor Pan is recessed in the access box cover to make the tile flush with the rest of the floor. All that shows are the 1/16" rim and retaining screws. From a few feet away, it's practically invisible!

SPANG UNDERFLOOR DUCT

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH 22, PENNA.

This is just one of many advantages you design into a building when you specify SPANG Underfloor Duct or Headerduct. A SPANG system offers easy and economical installation . . . complete flexibility for future changes in the electrical needs of the building without extensive construction . . . and the latest designs in service fittings that harmonize with any interior furnishings.

For complete information, mail the coupon below.

The National Supply Company—Tubular Division
P.O. Box 416, Pittsburgh 30, Penna.

Please send me complete literature on Spang Underfloor Duct, Headerduct and Service Fittings.

Name_____

Title_____

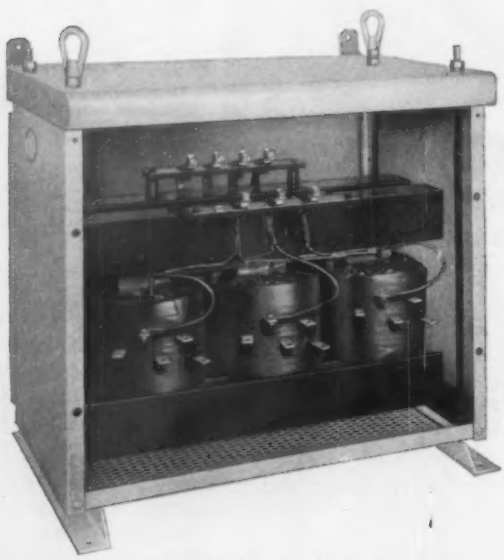
Company_____

Address_____

City_____ Zone____ State_____

When you select dry-type transformers initial costs can be false economy

SORGEL
SOUND-RATED DRY-TYPE
TRANSFORMERS



45 Kva 3-phase transformer with taps. Interchangeable wall or floor mounting. Front panel removed, showing interior.

COMPLETE LINE FOR EVERY PURPOSE up to 10,000 Kva, up to 15,000 volts, including special transformers and saturable reactors.

The same quiet SORGEL transformers are also incorporated in substations. Procurable with any type or make of switchgear, or from any electrical manufacturer.

The first cost of dry-type transformers is not always the final cost. Don't be misled; the lure of lower prices often camouflages operating and installation costs. SORGEL SOUND-RATED DRY-TYPE TRANSFORMERS are designed and constructed for long life. They provide the absolute ultimate in operating efficiency, ease of installation, overload capacity and long-range economy.

SORGEL offers these proven advantages

LOWER COPPER LOSS — Coils are liberally designed for the most effective use of the latest developments in insulating materials, have large air ducts for low hot spot temperature and are vacuum-impregnated to provide a co-ordinated insulation system.

LOWER CORE LOSS — Cores are designed with the industry's lowest magnetic flux densities, resulting in low core loss and the lowest sound level. The entire unit is secured within a substantial frame. Large units are mounted on vibration dampers to minimize vibration transmission to adjacent areas.

QUICKER AND EASIER INSTALLATION — The enclosure is self-supporting and entrance can be made on sides, top, bottom or back. Connecting is made easier by means of solderless connectors on terminal blocks in roomy connection compartments. Units up to 75 Kva single phase and 45 Kva 3-phase, are furnished for interchangeable wall or floor mounting.

Over 43 years experience in the development, manufacturing and application of transformers, has made these achievements possible.

You will be doing your company or customer a great service when you select the best dry-type transformer made only by . . .

Sorgel Electric Company

836 W. National Avenue, Milwaukee 4, Wisconsin

Sales engineers in principal cities.

Consult the classified section of your telephone directory or communicate with our factory.

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Product News

Distribution System (1)

A new line of safety switches and control centers with the Unibus plug-in busway form a new system called "Masterguard." Integrated components provide total safety through interlocked disconnection of all line and accessible parts when opened for alteration, maintenance or inspection.

Personnel are fully protected from contact with live parts. Plug-ins, switches and control components are completely disconnected from the supply bus before they can be opened or removed. Other features include safety slides on the bus which must be closed before plugs can be connected or removed.

Individual safety switches afford similar safety through the use of an Isolet outlet box into which the switch unit is plugged. Distribution and control centers also have plug-in components with protected bus and wiring features.

Electrical Distribution Products, Inc., Allentown, Pa.

Lighting Fixtures (2)

A new line of outdoor fluorescent lighting fixtures, called the "Broadstreeter," are for illumination of streets, expressways, shopping centers and service stations. The aluminum, fully-weatherproofed fixture is designed to provide more light per watt with less glare. It is available in 4- and 6-ft sizes. Fixture is designed for the latest high wattage lamps and standard high output lamps. It is a 110-125-volt, 60-cycle operation, and is available for operation on other voltages.

Metalcraft Products Co., Inc., Philadelphia 35, Pa.

Pipe Hanger (3)

A new Speedi no-bolt pipe hanger No. 70 will accommodate ½ and ¾ in. EMT, ½ in. rigid, ½ in. flexible steel conduit as well as aluminum, plastic and liquid-tite raceways. It is a one-piece unit that is easy to install and handles many types of raceways.

Tomic Sales and Engineering Corp., Detroit, Mich.

Switch (4)

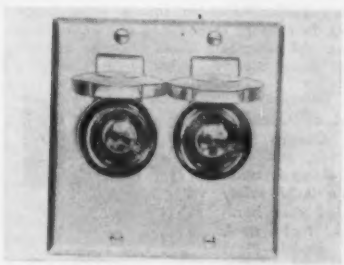
A new oiltight pressure switch for heavy duty industrial applications on machine tool hydraulic systems operating at pressures up to 5,000 psi. Bulletin 836, Type T, is a compact unit with a die cast aluminum enclosure that is completely sealed to exclude oil and water. It also meets NEMA 12 requirements. Switch has a calibrated range scale and indicator to show the operating pressure. A visible trip indicator also shows when the contacts operate. The differential adjustment controls the reset pressure only, and it is accessible from the front when the cover is removed. The contact block has two isolated circuits with one normally-open and one normally-closed set of double break, silver alloy contacts. These may be arranged for single pole, double throw operation, or separate circuit operation. Literature is available.

Allen-Bradley Co., 136 W. Greenfield Ave., Milwaukee 4, Wis.

Threading Machine (5)

A new portable pipe and bolt threading machine, called the "552," will ream, thread and cut-off all sizes of pipe from ⅛ in. to 2 ins. It has a ½ hp universal, geared head variable speed motor. A feature is the wide choice of floating-type, adjustable die-heads available. You can select either radial or tangential type. Both are interchangeable on this machine. A new oil control valve is conveniently mounted on the operator's side next to the motor switch.

Oster Manufacturing Co., 1340 East 289th St., Wickliffe, Ohio



Fuse Block (6)

A complete line of fuse blocks, fuse-switch assemblies, fuse-receptacle assemblies, designed to block "shorts," overloading, etc. at the source. These plug-fuse devices may be installed in either a 2-gang box such as the Lt-11, or in any flat-face FS fitting. Made of .040-in. brass and spray-finished in corrosion-resistant aluminum, the WF74-2 is supplied complete with die-cast aluminum snap-type covers, weatherproof rubber gasket and mounting screws. UL approved.

Perfect-Line Mfg. Corp., Old Country Road & RR Ave., Hicksville, L. I., N. Y.

Latrobe

"TRU-LEVEL"

Fully Adjustable

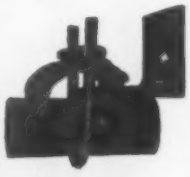
FLOOR BOX

A 4 inch sheet steel, galvanized octagon watertight floor box, with a 3¼" opening—large enough for the hand to fit into, in order to make inside conduit attachments.
A ½ inch adjusting ring and 2½ inch long screw legs make for quick and easy true-leveling.
Two ½" and two ¾" K O's in sides—three ½" and two ¾" K O's in bottom.
Listed under re-examination service of Underwriters' Laboratories, Inc.

Two Gang Adjustable Floor Box

Adjustable Boxes come in single-round or square bodies. Also in square type Single Gang, Two Gang, Three Gang and Four Gang Boxes. All adjustable boxes are now bonded which makes them fire-proof.

"Latrobe" Pipe or Conduit Clamp



This clamp is made with a double safety bite of case hardened tool steel. Two models—Right Angle and the Parallel support. Each model comes in 11 sizes to handle pipe or conduit ½" thru 4".

Latrobe Products

Non-Adjustable Floor Boxes
Adjustable Floor Boxes
Gang Boxes—Cover Plates
Junction Boxes—Nozzles
Pipe or Conduit Hangers
Insulator Supports
Cable Supports—Fish Wire
Staple and Cable Clips

Sales Representatives in all principal Cities.

Fullman Manufacturing Co.

1209-1215 JEFFERSON STREET
LATROBE, PA.

Time Meter (7)

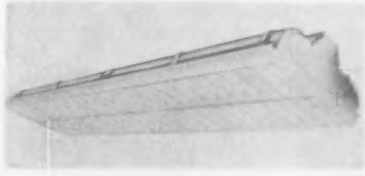
A new line of running time meters called "Standco." These are available in 3½- and 2½-in. flush mounting, panel type of meter, both in bakelite and metal cases, unsealed, and hermetically sealed. They register in hours and tenths of hours, hours only, or minutes only, and are available for 115-volt, 220-volt, and 440 volts, either 60 or 50 cycles. Bulletin No. 810 is available.

Herman H. Sticht Co., 27 Park Place, New York 7, N. Y.

Capacitor Equipments (8)

Large metal-enclosed capacitor equipments that use 50-kvar capacitor units and designed for distribution substations are now available. Designated "Mod-ul-var 50," these capacitor equipments use 50-kvar capacitor units that are assembled into 1200-kvar modules. Field installation, outdoor or indoor, involves only bolting the required number of modules together. A separate bus entrance or circuit breaker compartment is bolted at one end to complete installation. They are available from 2400 to 13,800 volts, wye connected, and in bank sizes from 1200 to 6000 kvar.

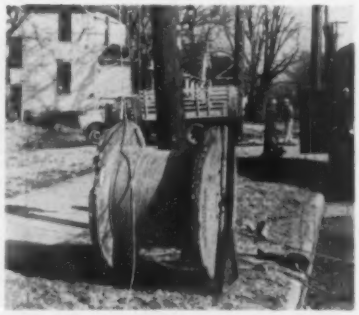
Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.



Industrial Fixtures (9)

This line of industrial fixtures is designed specifically for all new high-output lamps, including VHO, SHO and Power Groove. The louver is an improved 30° by 30° baffle-type all steel design, finished in baked white enamel. Each 4-ft louver section (two are used for 8-ft fixtures) is locked with captive fasteners. Provision is made to automatically center louvers and protect blades against damage. Servicing is by dropping louvers on permanent safety chains. The fixture is Series 88 Power Groove Industrialist, and includes 48- and 96-in. two-lamp models with porcelain enamel reflectors. Mounting is by stems, chains or on surface.

AllBrite Division, Curtis-AllBrite Lighting, Inc., 352 Shaw Road, South San Francisco, Calif.



Cable Reel Lifter (10)

Large cable reels with broken or damaged flanges can be safely lifted and mounted for cable pay-out with the Hykon Reelift. It lifts the reel and supports it on an axle, permitting the reel to turn freely and pay-out cable in the shop, on the job or in the field. The axle is adjustable for reels of different diameters. The device enables two men to mount fully loaded reels of 750,000 CMC without the use of rollers, patched flanges, jacks or makeshifts. Dimensions are 3 by 2 ft on the base, 4 ft in height.

Hykon Manufacturing Co., P. O. Box 923A, Alliance, Ohio

Wire Connector (11)

A new wing-nut wire connector designed to make it easier to join heavy gauge, hard wires used in branch circuit wiring. Features are built-in-wrench, spring-tension grip and nylon insulating cap. Connector is available in two sizes for wire combinations from four No. 16 through two No. 6 with one No. 12. Both connectors are primarily intended for branch circuit wiring, machine hook-ups, etc. and are approved by UL for pressure cable connections, 600-volt, 1000-volt in signs or fixtures, branch circuit and fixture wiring up to 105°C.

Ideal Industries, Inc., 1041 Park Ave., Sycamore, Ill.

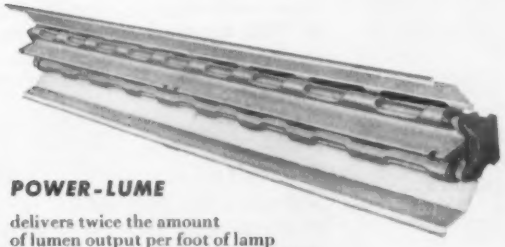
BETTER LIGHTING IS EASY

TO INSTALL AND MAINTAIN WITH JOB-DESIGNED FIXTURES BY

WHEELER • FULLERTON

FIXTURES engineered by Wheeler-Fullerton anticipate your modern lighting needs and provide easy installation plus efficiency and low-cost maintenance. Whatever your lighting requirements you can depend on WHEELER-FULLERTON for maximum performance with economy.

FOR ANY INDUSTRIAL INSTALLATION



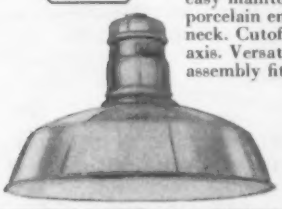
POWER-LUME

delivers twice the amount of lumen output per foot of lamp length. For medium to high mounting applications. 8′ fixture provides maximum effectiveness in light distribution, ease of installation. Self-cleaning, easy maintenance.

WHEELER RLM

STANDARD DOME DURATACH

a quarter-twist removes the entire unit for easy maintenance of this durable porcelain enamel reflector with vented neck. Cutoff is 17½° below the horizontal axis. Versatile Duratach reflector assembly fits any Duratach canopy.



FOR ANY COMMERCIAL INSTALLATION

STANDARD TROFFER—No. TR 240 KMH

for individual or continuous row mounting. Panels are in 48″ lengths presenting a neat appearance. "Magic Hinge" door provides easy access for relamping. Wide variety of shielding media available.

SHALLOW SURFACE—"LOWELL"

modern design with plastic sides; solid or louvered shielding. Two, four and six lamps; rapid start for slimline.

Send for complete catalog

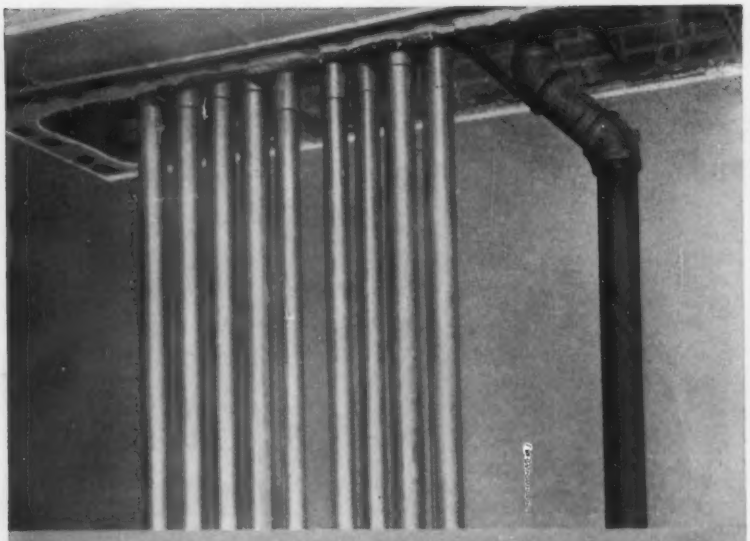
WHEELER • FULLERTON

Lighting Division • Franklin Research Corp.

275 CONGRESS STREET, BOSTON 10, MASS.

WF

Factories at HANSON, MASS. and NORWALK, CONN.



REYNOLDS ALUMINUM Electrical Rigid Conduit

lightweight! non-corrosive! competitive in cost!

Reynolds Aluminum Electrical Rigid Conduit cuts both installation and maintenance costs. Weighing approximately two-thirds less than steel conduit, aluminum conduit is easier to handle, faster to install. No special tools or equipment are required. Bending is easier because aluminum "sets"—less spring back.

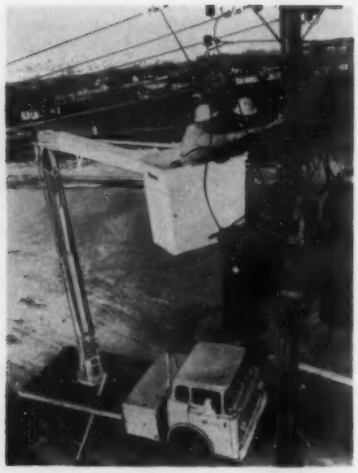
Aluminum conduit can't rust—ever. This means no replacement worries due to rust—no periodic protective maintenance problems—no rust on walls or surrounding fixtures—no rusting of threads. Aluminum conduit is also corrosion-resistant to water, weather and most industrial atmospheres. Aluminum conduit is non-magnetic. Voltage drop is reduced—longer conduit runs or smaller conductors are possible. Aluminum conduit won't spark from accidental contact blows from hard objects—excellent for use in inflammable areas and atmospheres.

The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

For more information and names of Reynolds Aluminum Electrical Rigid Conduit outlets, call your nearby Reynolds Sales Office or write *Reynolds Metals Company, Box 2346-ET, Richmond 18, Virginia.*

Also write for descriptive brochure.

Watch Reynolds TV show—"WALT DISNEY PRESENTS"—every week on ABC-TV.



Platform (12)

The Pitman Aerial platform is now available with a fiber glass boom designed to afford maximum protection against electrical hazards. With the exception of bronze bushings at the point where the operator's platform attaches to the boom, all parts of the boom from the base outward are constructed of insulating materials. The boom has been tested with potentials of 230,000 volts ac between the operator's platform and the grounded boom base without flashover. Two models are available, the 40HFD for working heights up to 40 ft and 50 HDF for working heights up to 50 ft.

Pitman Manufacturing Company, Grandview, Mo.

End Belt (13)

A newly-designed end bell for use on threaded conduit. It is used to provide a smooth, rounded pulling surface, preventing damage to cable sheath or insulation as it is pulled through conduit. Standard Type "TNA" end bell is of cast aluminum, and will accommodate conduit ranging from 1¼ ins. to 5 ins. Bronze fittings are also available.

O. Z. Electrical Manufacturing Co., Inc., Brooklyn 17, N. Y.

Batteries (14)

A new series of flat-plate batteries has been added to the Exide plastic-jar line of stationary batteries, extending the range of 8-hr capacities available in this line upward by 1020 amp-hrs. Designated Type FWA, the series consists of four sizes with 8-hr capacities ranging from 840 to 1680 a-h. They supplement Exide's PWA and EWA

series which have capacities ranging from 50 to 660 a-h. These types —all designed for float-charge service—feature patented corrosion-resistant Silvium alloy in lead-antimony grids; special explosion-control devices; shock-absorbent plastic jars and super-impact plastic covers. Assembled as single-cell units, the FWA models have 15, 19, 23 and 29 plates. Capacity ratings (8-hr) respectively are 840, 1080, 1320 and 1680 a-h. They are supplied either charged and filled with electrolyte, or dry-charged.

Exide Industrial Div., The Electric Storage Battery Co., Rising Sun and Adams Aves., Philadelphia 20, Pa.

Cable Spacer (15)

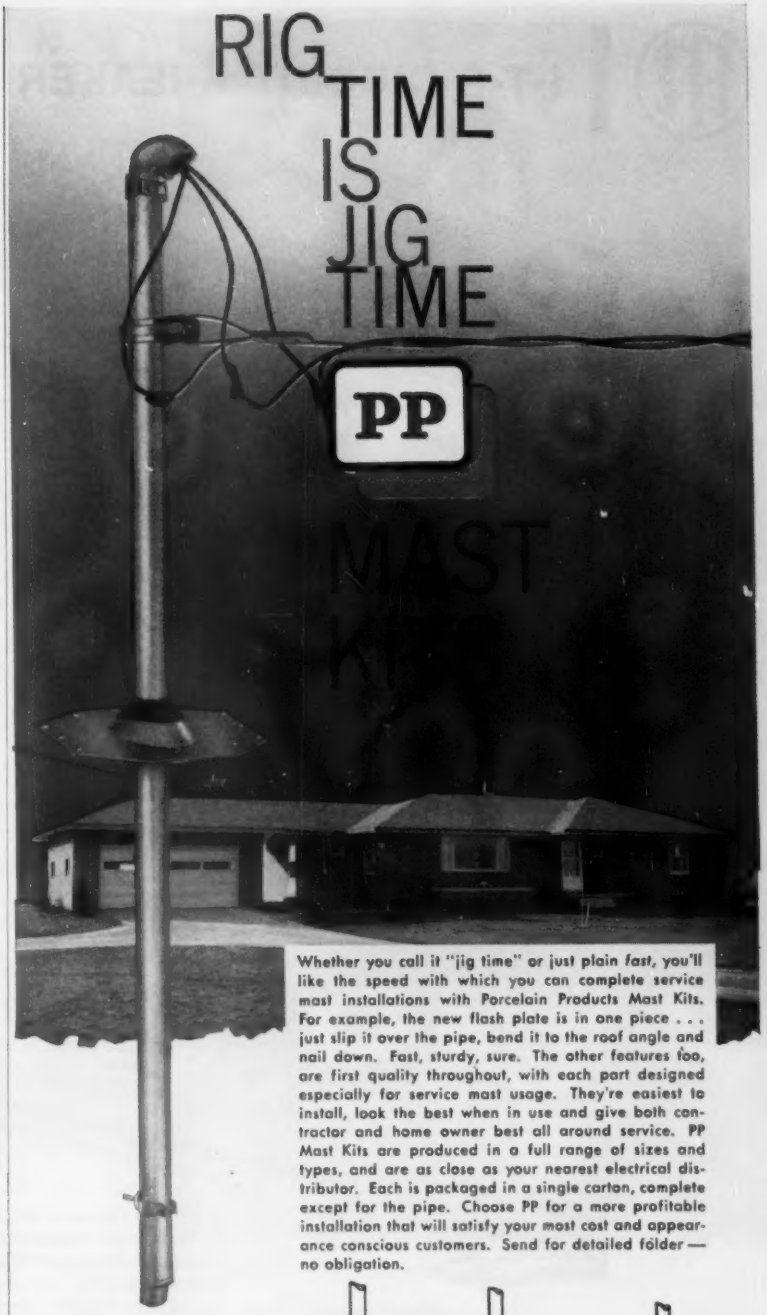
A new, one-piece, "wrap-around" type of cable spacer for overhead distribution systems. Designed for use with the new messenger-supported aerial cable systems, the PLM cable spacer features unit construction that eliminates need for bolts, nuts, tools or any separate parts to install. Spacer is installed by hanging spacer on messenger, then "wrapping" it around conductors and snapping shut into latched position. They are designed of Lucite and supplied to fit cables from ⅜ in. to 1 in. outside diameter, for 3-phase cable systems to 5 kv rating.

PLM Products, Inc., 3875 W. 150th St., Cleveland 11, Ohio

Lighting Fixture (16)

The LV series of lighting fixtures are designed for wide area lighting in any commercial installation. They are 3¾ ins. deep. Curved or straight extruded Polystyrene plastic sides provide uniform glow. Curved luminous steel sides are finished in high reflectance baked white enamel. "V" shaped channel cover and cross baffle one-piece assembly provides for pleasant lamp shielding. Fixtures can be mounted directly to ceiling or suspended by stems as direct-indirect units, singly or in continuous rows. They are available in two or four lamps in 4-, 6- and 8-ft lengths.

Leadlight Fixture Co., 800-100th Ave., Oakland 3, Calif.



Whether you call it "jig time" or just plain *fast*, you'll like the speed with which you can complete service mast installations with Porcelain Products Mast Kits. For example, the new flash plate is in one piece . . . just slip it over the pipe, bend it to the roof angle and nail down. Fast, sturdy, sure. The other features too, are first quality throughout, with each part designed especially for service mast usage. They're easiest to install, look the best when in use and give both contractor and home owner best all around service. PP Mast Kits are produced in a full range of sizes and types, and are as close as your nearest electrical distributor. Each is packaged in a single carton, complete except for the pipe. Choose PP for a more profitable installation that will satisfy your most cost and appearance conscious customers. Send for detailed folder — no obligation.

With upper courses of shingles removed, FLASH-PLATE is slipped straight down pipe.

FLASH-PLATE is twisted to conform to pitch of roof and nailed in place.

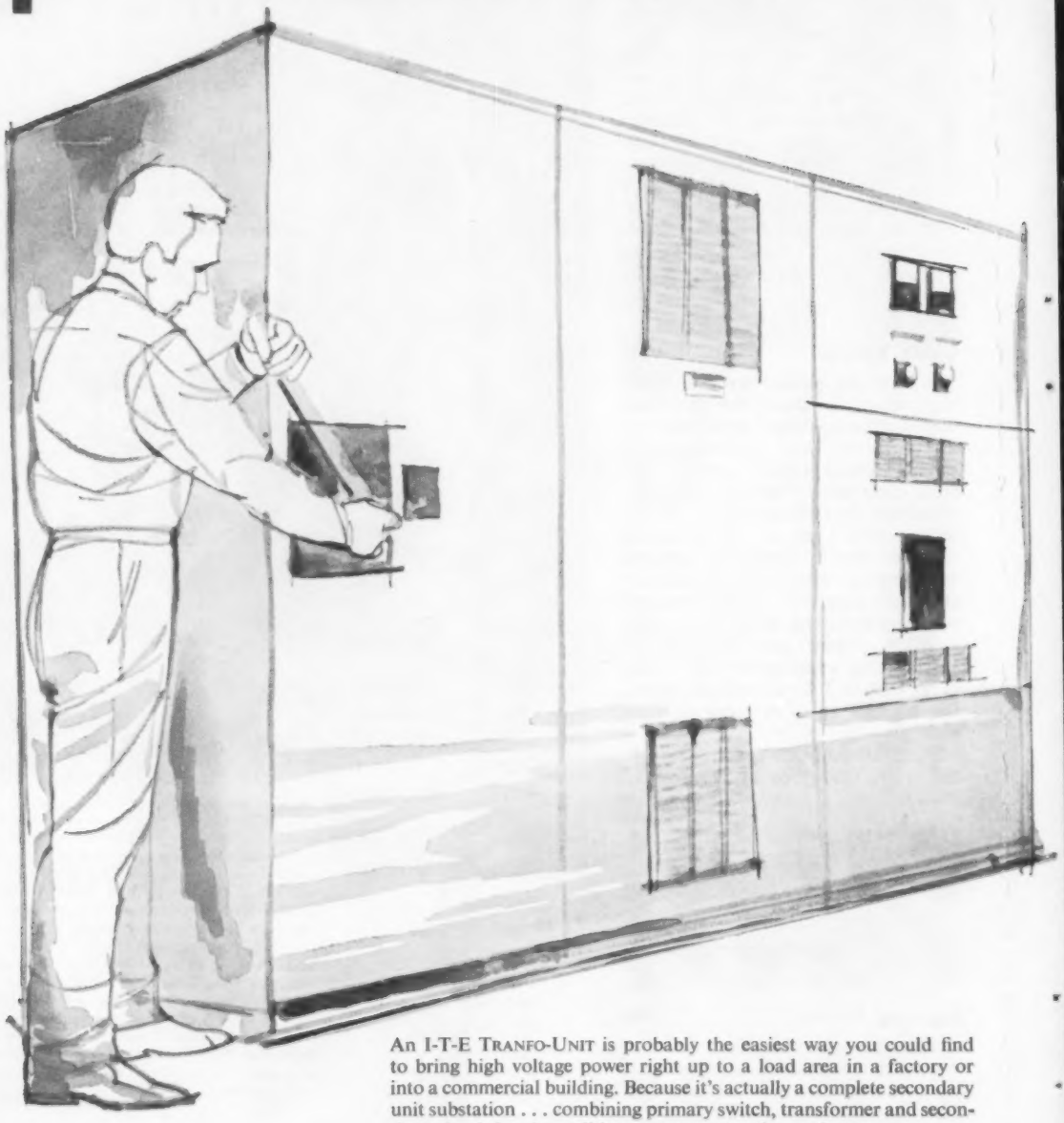
Upper courses of shingles are replaced and collar is slipped down into place.

PP

PORCELAIN PRODUCTS CO.

225 N. PATTERSON ST. CAREY, OHIO

I-T-E CIRCUIT BREAKER COMPANY



EASY

An I-T-E TRANFO-UNIT is probably the easiest way you could find to bring high voltage power right up to a load area in a factory or into a commercial building. Because it's actually a complete secondary unit substation . . . combining primary switch, transformer and secondary circuit breakers all in one neat, attractive package.

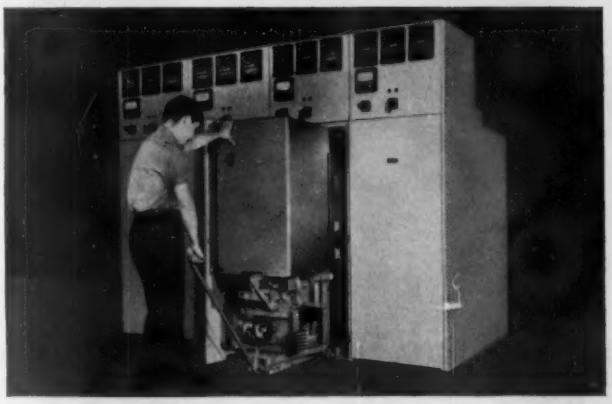
A TRANFO-UNIT is *delivered* as one package too (in all but the very largest sizes), so installation is very easy. Just put it in place, connect the leads, and that's all there is. No time-consuming handling of countless separate pieces of equipment.

You can order TRANFO-UNITS pre-engineered to your own particular application requirements . . . in a wide range of ratings up to 3000 kva. Available for both indoor and outdoor installations. Since they're completely self-contained, they require minimum floor space and no fence.

How much does this extra convenience and safety cost? No more than hodgepodge arrangements of assorted gear. The TRANFO-UNIT is more evidence of I-T-E's constant policy: to give more value at no extra cost. Do you use I-T-E electrical equipment? If not, why not?

Circuit breaker protection for single circuits. Use I-T-E URELITE individually enclosed power circuit breakers to protect large load single circuits in factories and as power entrance devices in many commercial buildings. Easy to install. Extra roomy cable box makes it easy to pull and bend cables. All mounting equipment and contact assemblies can be removed for installation. Box can accommodate cables one size larger than standard and still leave working room. Provision for four conduits at both top and bottom of box means utmost flexibility in cabling. Enclosure is shipped separately. During installation, breaker remains in protective carton

Switchgear easy to install. I-T-E metal-clad switchgear reduces installation effort to an absolute minimum. Base frame is shipped in advance for setting into floor. Switchgear arrives preassembled in large units for quick positioning and connection. Very little actual assembly work required. Sturdy construction makes possible required handling without risk of frame distortion. Units are engineered and manufactured with care to insure that they will fit accurately together at the site. Their quality construction means customer satisfaction.



Space saver . . . cost saver. Big protection in small size. I-T-E CORDON® circuit breakers combine the space and cost economy of molded case construction with interrupting capacity of up to 100,000 amp. They cost approximately one-third less than alternative devices and require only half the panel space. Available loose or individually enclosed in a broad range of ratings for a wide variety of applications. Especially valuable for circuits fed by high-current capacity lines.

SEND COUPON OR WRITE

Get complete, up-to-date information on I-T-E equipment.

I-T-E Circuit Breaker Company CO-2
1900 Hamilton St., Philadelphia 30, Pa.

- ☐ TRANFO-UNITS
- ☐ URELITE circuit breakers
- ☐ Metal-clad switchgear (4.16 and 13.8 kv)
- ☐ CORDON circuit breakers
- ☐ Molded case circuit breakers
- ☐ Power switching centers
- ☐ Metal-enclosed bus
- ☐ Secondary unit substations
- ☐ Other .....

Name.....Title.....

Company.....

Street.....

City.....Zone....State.....

T-rific!

PARAGON'S 4000 SERIES TIME SWITCH

You're further ahead in every way with Paragon's new 4000 Series. Its 40 ampere tungsten design gives it the highest capacity available in general purpose, low-cost time switches . . . *33⅓% greater safety factor!* And free-floating "make" and "break" contacts prevent contact welding . . . eliminate costly call-backs.

Other advantages include: easy installation, skip-a-day versatility, compact styling, sturdy construction.

OBEYS THE SUN!
ASTRO DIAL permits setting the 4000 Series to go ON at sunset, OFF at sunrise . . . or any other pre-selected time. No need to reset for seasonal changes.

. . .

IGNORES POWER FAILURES!
SPRING-WOUND CARRYOVER keeps the 4000 Series operating dependably during power failures. When power is restored, the carryover is automatically rewound by the timing motor.

CATALOG 5919 HAS FULL DETAILS. WRITE TODAY!

PARAGON ELECTRIC COMPANY
1614 TWELFTH STREET • TWO RIVERS, WISCONSIN
TIME IS MONEY — CONTROL IT WITH PARAGON

Relay (17)

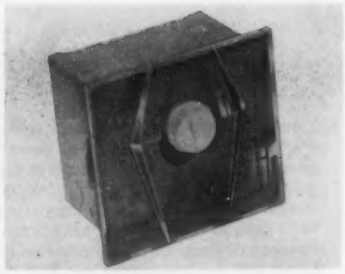
New self-contained photoelectric relay is designed for indoor use on limit switch type applications such as conveyor lines, doors and loading devices where the breaking of a light beam can be used to perform a job. The unit's small output relay is operated directly by its cadmium sulfide power cell. The photoelectric relay draws its full operating power of 57.5 volts directly from transformer which supplies power to light source. Unit operates at a maximum of 200 operations per minute at a minimum illumination level of 25 fc. Complete light beam cut-off is required to operate the power cell. Unit may be mounted in any position. Bracket for wall mounting permits 360° rotation, 30° tilt up from the horizontal and 90° tilt down to the vertical. Spade terminals are used. A 9-ft length of cable is supplied.

General Electric Co., Schenectady 5, N. Y.

Trencher (18)

A new gear-draulic trencher for International Harvester 340 and 460 utility tractors, will trench at widths from 6 to 14 ins. and at depths to 6 ft. It will dig up to 800 ft. of trench per hour. It has a forward propulsion drive utilizing a specially installed power-take-off that transfers power from the tractor through a combination variable hydraulic drive and speed reducer, to a geared spacer that, in turn, returns the power back into the tractor's power train at a "creep" speed. This converts the tractor's speeds from miles per hour to feet per hour. It can be engaged or disengaged to permit the conventional tractor drive to operate at regular speeds. The variable hydraulic drive automatically adjusts the forward speed to intermittently changing soil conditions for uninterrupted smooth trenching.

Auburn Machine Works, Inc., Auburn, Neb.



Dimmer (19)

A new wall-mounted dimmer with fingertip control to provide variable light level for both fluorescent and incandescent lights. Features are: a single dial control with a built-in on-off switch; a transparent face plate; automatic reset circuit breaker; single terminal panel. Unit is a transformer type switch. Dimmer controls up to eight rapid-start 40-watt fluorescent lamps, or eight trigger-start 20-watt fluorescent lamps, and any number of incandescent lamps up to a total load of 360 watts. Dimmer can be used with chandeliers, accent lights, cornice, cove and valance lighting.

Thomas Industries, Inc., 410 South Third St., Louisville 2, Ky.

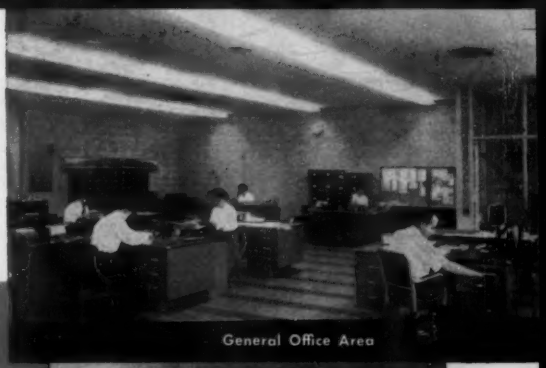
Floodlight (20)

New heavy-duty mercury vapor floodlight, Type MVE-210, 1000 watts, is dust-tight and weatherproof. Reflector and lens are 20 ins. in diameter. Housing is cast aluminum. By means of adjustable stops, floodlight can be turned around or tipped over for relamping and cleaning. Both horizontal and vertical degree scales are provided. Different types of mounting are available.

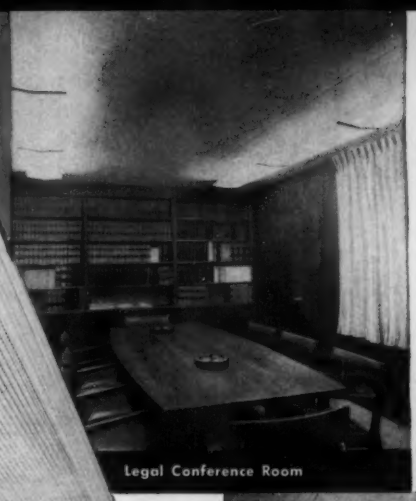
Crouse-Hinds Company, Syracuse 1, N. Y.

Distinctive Lighting at Modest Cost . . . for Interiors of All Types

SABRE* by miller



General Office Area



Legal Conference Room

Dental Office

Furniture Store

Restaurant-Luncheonette

Rarely do you find a fluorescent lighting fixture that is *truly* distinctive. Occasionally, some measure of distinction is reached through appearance, lighting performance, or decorative effect produced. SABRE by Miller, however, achieves *true distinction* through a unique blend of *all* these virtues. And, it's available at modest cost.

SABRE is rapidly becoming one of the most wanted fluorescent fixtures in America. Pictured are just a few typical interiors where it is already doing a superlative lighting job. SABRE fits interiors of all types — large or small, new or old.

Styling with trim, crisp lines produces a sweeping effect and enhances decor . . . efficiency of 74½% means fewer fixtures needed per footcandle to make today's high lighting levels possible . . . one-piece, wrap-around refractor of prismatic, crystal clear plastic provides sparkle, with comfortable viewing from all angles.

For a lighted demonstration, contact your Miller distributor. And, for full catalog information on this unique fixture write Dept. 8959.

THE **miller** COMPANY • MERIDEN • CONN.

LIGHTING BY **miller** SINCE 1844

ov·fi

*Reg. Trade Mark

now --

SLIP

WIRES

through conduit!

it's fast and easy

with **IDEAL**

WIRE LUBE®

IDEAL WIRE LUBE is a new-formula lubricant applied with hand or brush to wires or cables being pulled into conduit.

WIRE LUBE protects insulation against breaks and strains because the wire or cable "rides" on a slippery film.

WIRE LUBE soon dries on wire into a talc-like powder... making it easier to remove wire from conduit if necessary later.

Use WIRE LUBE on rubber or plastic covered wire or cable. WIRE LUBE is non-corrosive, non-combustible, and perfectly safe for hands or clothing.

Sold through America's leading distributors. (In Canada: Irving Smith, Ltd., Montreal)

FREE LITERATURE • MAIL THIS COUPON

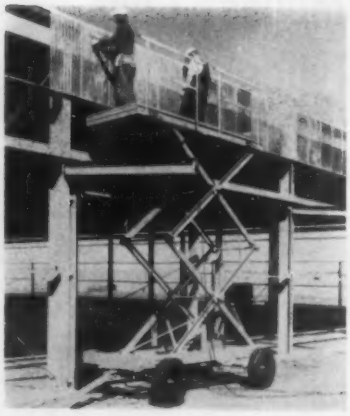
IDEAL INDUSTRIES, Inc. **IDEAL**
1041-H Park Ave.
Sycamore, Illinois

Please send catalog data on IDEAL WIRE LUBE.

Name_____

Address_____

City_____ Zone___ State_____



Scaffold (21)

The new Sky Witch, a portable materials lift and hydraulically elevating scaffold, is now available in a variety of sizes and capacities. It is made with standard platforms ranging in size from 2½ by 7½ by 24 ft to elevate to heights from 10 to 24 ft, lifting loads up to one ton. Unit is available on skids for mounting on conveyance, mounted on casters, pneumatic-tired wheels and trailers. Raising and lowering of Sky Witch is controlled from the platforms by a single lever regardless of power unit used. Standard models are available with a choice of gasoline or electric motors to power the hydraulic system.

Charles Machine Works, Inc., 699 *B St., Perry, Okla.*

Controls (22)

A new line of Type "DP" duplex pump controls—combination and non-combination—were developed for control of motors on twin pump installations where two pumps operate either individually or in conjunction to provide the necessary pumping operation depending upon the pumping rates required. All combination Type "DP" provide a disconnect means for every motor, either through the use of a disconnect switch, fusible or non-fusible, or a thermal magnetic trip circuit breaker placed in series with the starter and load. All duplex pump controls have the front operated mechanism mechanically interlocked with cover of enclosure. Non-combination types consist of two Type RA magnetic starters and a single type "MR" relay for electric alternating mounted in one enclosure. They are normally supplied with 3-pole construction for 3-wire, 2- or 3-phase power systems.

Arrow-Hart & Hegeman Electric Co., 123 *Hawthorn St., Hartford, Conn.*

Guy Hook (23)

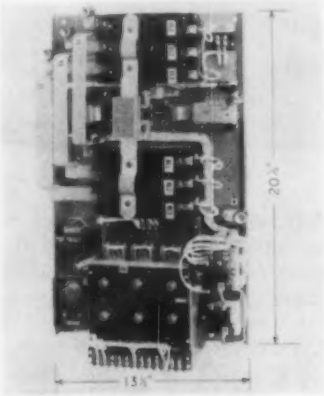
New improved MIF guy hook will accept all types of guy deadending devices from 0 to 96° permitting the use of one attachment for both down and span guys. The made up guy hook can be installed at any time during construction, either before or after pole is set. Channel shape of back provides fitting to any pole diameter and ears accept a wide range of strand diameters.

Malleable Iron Fittings Company, Branford, Conn.

Fittings (24)

A complete line of aluminum fittings to be used on aluminum conduit. Included in the line are cable supports, expansion fittings, end fittings, split couplings, pull box fittings, U-bolts, terminators and bushings.

O. Z. Electrical Manufacturing Co., Inc., 252 *Bond St., Brooklyn, N. Y.*



Switch (25)

An automatic transfer switch, T-100A, employing a dual circuit breaker design that utilizes two opposing solenoids through a common transfer linkage for transfer power. The "two-position" solenoid-actuated switch provides automatic transfer of power and light service to an emergency source in the event of failure of the normal source with the load automatically returned upon normal restoration. Available to 600 volts, 100 amps, the switch affords interrupting capacities to 10,000 amps rms. Switch is operated by power from the side to which the load is transferred. Switch is available for ac or dc applications, for ratings to 600 volts ac and 250 volts dc.

Lake Shore Electric Corp., 205 *Willis St., Bedford, Ohio*

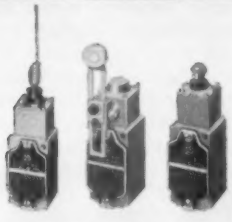
AUTOMATION BEGINS HERE

. . . Insist on Allen-Bradley accessories for continuous automatic production

In this broad line of Allen-Bradley accessories, each and every unit carries the traditional A-B trademark of *quality* that stands for trouble free operation. Rugged construction, and maintenance free, silver alloy contacts provide the reliability that is essential to the continuous operation of *your* automatic production machines.

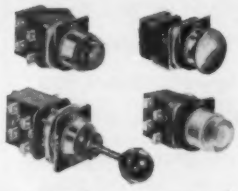
Profit from the experience of the leading machine tool builders . . . insist on Allen-Bradley *quality* motor control *all the way!*

Special push button panels can be assembled to your specifications.

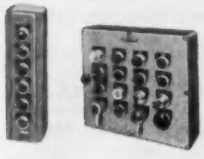


OILTIGHT LIMIT SWITCH
Bulletin 802T with sealed heads and bodies. Various operators.

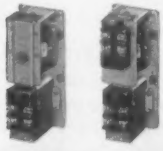
PRECISION LIMIT SWITCH
Bulletin 802 oiltight. Responds to very small operator travel.



OILTIGHT CONTROL UNITS
Bulletin 800T. Choice of push buttons, lights, and switches.

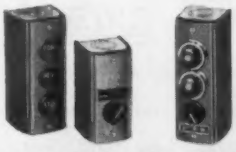


OILTIGHT CONTROL STATIONS
Bulletin 800T for up to 16 units in die cast aluminum enclosure.

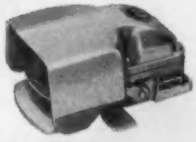


PNEUMATIC TIMERS
Bulletin 849. Reliable and accurate. For on-delay or off-delay.

OILTIGHT PRESSURE CONTROL
Bulletin 836. For hydraulic systems with pressures to 5000 psi.



STANDARD DUTY PUSH BUTTONS
Bulletin 800. Up to three units, also pilot lights and switches.



FOOT SWITCH
Bulletin 805. In rugged die cast housing for toughest service.

ALLEN-BRADLEY
Member of NEMA

QUALITY MOTOR CONTROL

Allen-Bradley Co., 1307 S. First St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

"WHY SO MANY WALL ANCHOR SIZES?"

NOW...

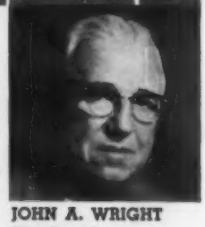
ONLY TWO SIZES OF wing-ding

MADE IN U.S.A. U.S. PAT. NO. 2,762,252

WALL ANCHORS FOR ALL WALLS

AND ONE SIZE FOR HOLLOW DOORS

"Your WORKMEN need not carry Tool Kits full of different size anchors or drills . . . They need only two size drills, 1/4" and 5/16", and two size WING-DINGS" . . . They can anchor anything up to 500 pounds, to walls up to 1 1/4" thick . . . Let us send you free samples of WING-DINGS. Just request them on your letterhead."



JOHN A. WRIGHT
Vice President

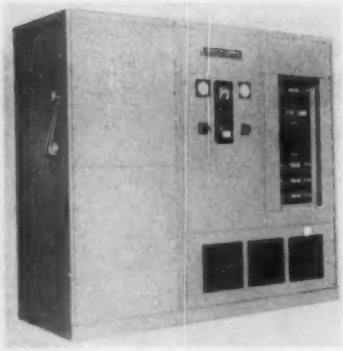
SIX TO ONE FASTER INSTALLATIONS WITH NEW wing-ding GUN

Operates simply and safely. It's fast. Operator can install six wing-dings with gun while one is being installed by hand. Installs all 3 sizes. For full details request Bulletin No. 7925.

SOLD ONLY THRU DISTRIBUTORS

DIAMOND EXPANSION BOLT CO., INC.
GARWOOD, NEW JERSEY

BRANCHES: Atlanta, Boston, Chicago, Dallas, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Seattle, St. Louis, Washington, D. C., Montreal, Toronto, Vancouver, Canada.



Substation (26)

A new Power-Zone package unit substation is available, measuring 79½ ins. high, 94 ins. long and 36 ins. deep. Because all components can be reached from the front, unit can be placed against a wall. They are available with capacities from 75 kva to 300 kva, with high voltages up to 4800 volts and low voltages up to 600 volts. The high-voltage section may be ordered with either an air interrupter switch or oil cutouts, with or without fuses.

Square D Company, 6060 *Rivard St., Detroit* 11, *Mich.*

Control (27)

A new automatic engine starting control, intended for fully automatic starting and stopping of engine driven generating sets. Features are: prevents recranking at full engine speed; designed to respond at 50% of normal battery voltage; operates over broad ambient temperature range; repeated or continuous cranking cycles provided by same panel; industrial control type components throughout; operates from a single pole contact on the automatic transfer switch or control station. Publication 653 is available.

Automatic Switch Co., Florham Park, N. J.

Starters (28)

Two classes of new oil immersed, explosion-proof, corrosion-resistant, weatherproof, 2000-5000-volt starters designed for hazardous and semi-hazardous locations have been announced. NEMA Class E1 starters are rated at 50-mva interrupting capacity and provide built-in short circuit protection to a motor on systems having a maximum of 50-mva capacity. Starters are available in a floor-mounted, liftout type with all components immersed in oil (Class 5911) and in a frame-mounted tank lowering type with

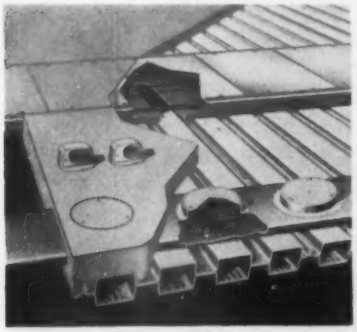
high voltage components immersed in oil and the low voltage control components mounted in explosion-proof air boxes (Class 5912). Basic design features include a recessed clear oil level sight gauge protected against external damage; segregated high and low voltage panels and components; heavy corrugated oil tank; stainless steel cover hardware; grounded center tap (110 volts) of the 220-volt circuit; adjustable overcurrent relays for short circuit protection.

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

Post Lanterns (29)

A new accessory, named "Lite-Guard," for post lanterns which automatically controls the on-off operations of outdoor lanterns, operates automatically without any switches. The Lite-Guard is activated by a photo electric cell that turns on the post lantern at dusk and then again automatically turns off the post lantern at dawn. Designed to offer protection for the home by providing outdoor light when the home owner is away. It is made to fit any 3-in. post.

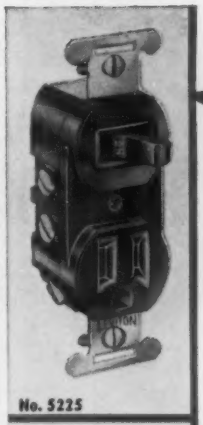
Progress Manufacturing Co., Inc., Castor Ave. and Tulip St., Philadelphia 34, Pa.



Floor Raceways (30)

Two new "Headerduct" systems, featuring increased wiring capacity, are designed for applications utilizing cellular steel floors. The new 15,000 series provides 20.294 sq ins. of duct capacity (2½ by 10 ins.), and the 14,000 series has a 9.2 sq in. capacity (1⅞ by 7⅜ ins.). Lengths of 3- and 5-ft are available in the 15,000 series, and 8-, 9-, and 10-ft for the 14,000 series.

National Electric Division, H. K. Porter Company, Inc., Pittsburgh 19, Pa.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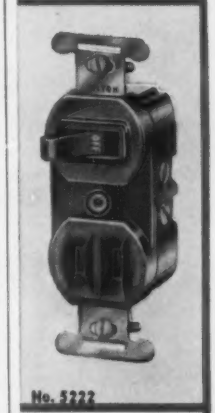
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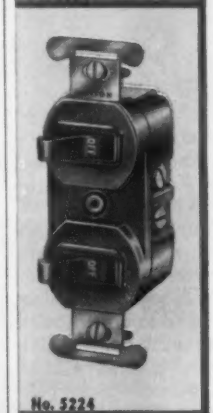
No. 5224

No. 5223 LB

Newest of the New!

FOUR SPECIFICATION GRADE COMBINATION QUIET SWITCHES

You've been waiting for!

LEVITON is the first to bring you four entirely new devices in the combination duplex line... the now popular mechanical Quiet Switch in combination with power outlets or pilot lights. The Quiet Switches are all precision-balanced with heavy special silver contacts, magnetic arc-snuffing action. The movement? So quiet you can hardly feel it!

The features? All these:

U-GROUND POWER OUTLETS offer maximum safety. Conform to N.E.C. requirements. Also accepts any 2-wire plug.

ALL POWER OUTLETS have bronze double-wiping contacts for longer life and pressure grip. Can be wired independent of, or controlled by switch.

PILOT LIGHT takes standard S-6 candelabra lamp that's easily unscrewed. Nickel-plated protective hood over lamp.

RUGGED CONSTRUCTION! Base molded of brown phenolic... covers of either brown phenolic or ivory thermosetting plastic. Heavy gauge rustproofed underslung steel strap is riveted through cover and body to form a permanent assembly.

EASY TO INSTALL! Large head No. 8 terminal screws have deep milled slots for easy wiring. Accommodate up to No. 10 conductors. Wiring diagram furnished with unit. Wide plaster ears on strap make wall alignment easier.

ECONOMY! Save installation costs and wall space—single gang box and wall plate are all that is needed.

No. 5225	No. 5222	No. 5224	No. 5223 LB
SINGLE POLE Quiet Switch with U-GROUND OUTLET	SINGLE POLE Quiet Switch WITH POWER OUTLET	TWO SINGLE POLE Quiet Switches ON SAME CIRCUIT	SINGLE POLE Quiet Switch with PILOT LIGHT
Rating	Rating	Rating	Rating
Quiet Switch: 15A—120V AC only	Quiet Switch: 15A—120V AC only	Quiet Switches: 15A—120-277V AC only	Quiet Switch: 15A—120V AC only
U-Ground Outlet: 15A—125V	Power Outlet: 15A—125V		Pilot Light: 75W—125V

Listed by Underwriters' Laboratories, Inc.

YOUR BEST JOBS ARE DONE WITH . . .

Write for full details today!

LEVITON

LEVITON MANUFACTURING COMPANY, Brooklyn 22, N. Y.

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For your wire needs, contact our subsidiary: American Insulated Wire Corporation

Profits

BUILD ~~BUSINESS~~

ELECTRICALLY!

RELY ON.....

National Price Service

Then.....

You can BE SURE of your material costs!

You can BE SURE that your resale prices include all overhead expense plus — A FAIR PROFIT!

HENDERSON-HAZEL CORP. Dept. A-98
13601 EUCLID AVENUE • CLEVELAND 12, OHIO

Gentlemen:
Please send me the complete story of National Price Service, how it will keep me up-to-date with changing material prices, and suggest profitable resale prices—quickly. No obligation.

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

NPS National Price Service

HENDERSON-HAZEL CORP.

13601 EUCLID AVENUE • CLEVELAND 12, OHIO

Floor Box (31)

A new adjustable sheet steel floor box, known as No. 190 "Tru-Level" series, was developed for concrete or tile floor, also wooden floors with concrete base. It is a fully adjustable 4-in. galvanized, octagon, watertight box. Box-body cover has a 3¼-in. opening, octagon box is 2½ ins. deep with two ½ in. and two ¾-in. knockouts in the sides and three ½ in. and two ¾ in. knockouts in the bottom. It is listed under re-examination services of UL.

Fullman Manufacturing Co., 1209 Jefferson St., Latrobe, Pa.

Meter Panels (32)

Individual convenience of mobile home meter panels for trailer parks. The fitted hinged cover assures raintight, weatherproof protection and can be securely locked to prevent tampering, vandalism or children's accidents. The plug-in receptacle is located at the bottom of the enclosure. They are constructed of heavy gauge, galvanized steel which has been Irridite processed. A wide range of models having either single or double meters are available to meet individual trailer park requirements. Having a 120/240-volt meter, 30-amp single pole breaker and 35-amp 120-volt 3-wire receptacle, meter panels can be easily converted in the field to take a 240-volt, 4-wire, 60-amp receptacle. Literature is available.

United Enterprises, 15735 S. Paramount Blvd., Paramount, Calif.

Signal Horn (33)

An ultra-flexible, vibratory horn of advanced design which simplifies the installation of emergency alarms and coded signal systems in public buildings, industrial plants and institutions has been developed. The Vibratone horn provides a choice of three styles, each with six different mounting variations. Modular accessories enable one basic unit to meet the widely varying audible signal needs of diverse areas such as production, storage, office, assembly halls and corridors. Horn unit fits into any 4-in. square electrical outlet box. Each basic horn unit is equipped with an individual volume control. Sound can be adjusted from a barely audible buzz to 101-103 decibels at 10 ft. Three horn models are available—grille type for offices, laboratories or other general areas.

Federal Sign and Signal Corp., 8700 So. State St., Chicago 19, Ill.

Fire Detector-Alarm (34)

A new home and farm fire detection-alarm system comprises six fire detector elements, 200 ft of wire, staples, screws, a 4-zone control panel with a system test button, battery and battery power supply gauge. Fire detectors signal an alarm if there is a sudden increase in temperature or if temperature reaches a pre-set fixed degree. Each detector monitors 2500 sq ft. They can be painted to match any decor and normally would be placed on ceilings of the cellar, kitchen and attic or heater room. The control-alarm panel normally is installed, either surface or flush-mounted, in the master bedroom with the alarm sounding also in or directly outside this room.

Kidde Ultrasonic & Detection Alarms, Inc., Clifton, N. J.

Crane (35)

A new hydraulic hand operated crane for lifts from pick-up trucks of electrical equipment. Available in both 1500- and 2500-lb capacities and one crane is interchangeable with any number of trucks equipped with crane mounting. Also comes with dolly mounting for warehouse use.

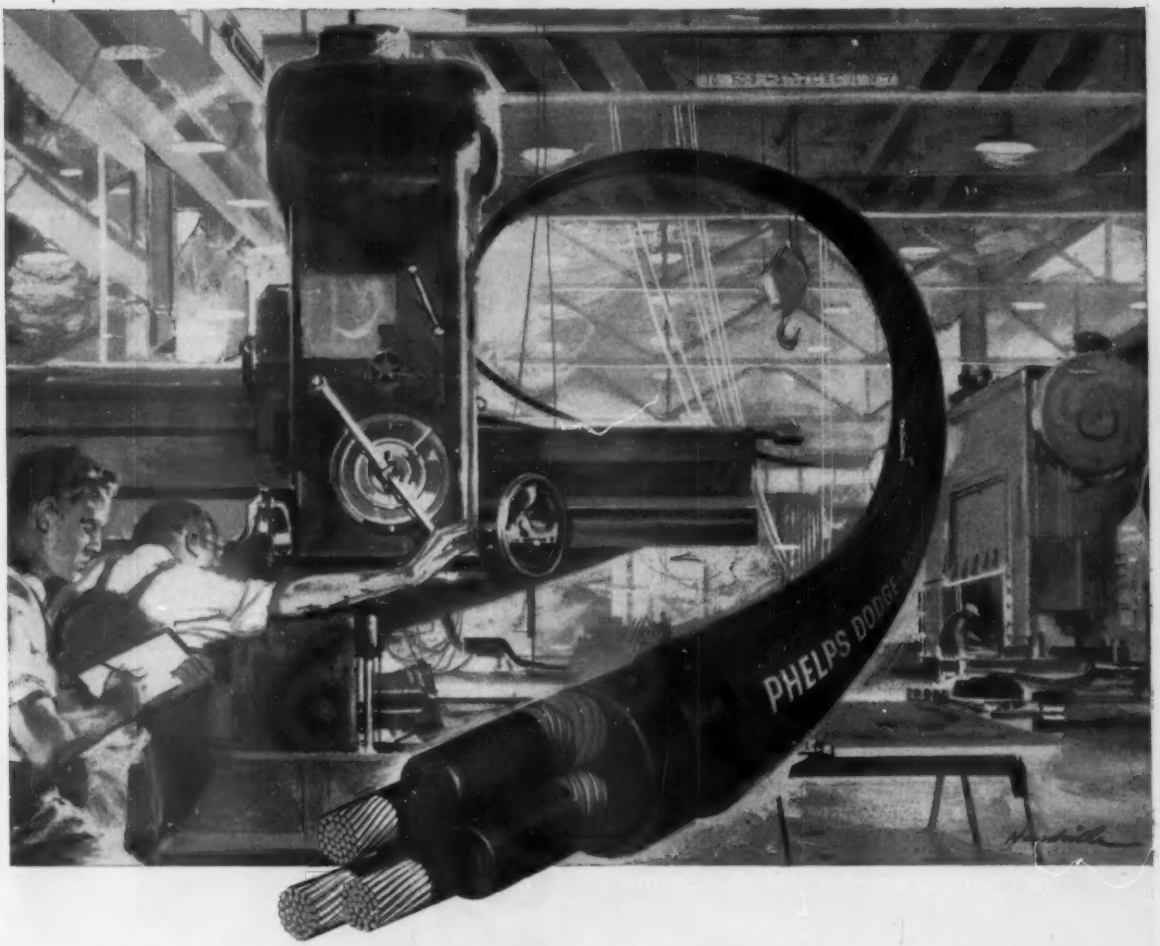
Ideal Crane Company, Inc., Box 516, Wichita Falls, Texas

Fittings (36)

The "GEJ" series explosion-proof fittings are available in a complete line of hub styles with 1¼- and 2-in. hubs in non-rusting, non-corroding aluminum alloy. They measure 6⅞ ins. in diameter and 3¼ ins. deep. They are available with blank flat as well as a 3- and 5-in. deep dome covers for Class I, Group C and D; Class II, Group E, F and G.

Killark Electric Mfg. Co., Vandeventer and Easton, St. Louis 13, Mo.

Steady plant production demands dependable power cable . . .



HABIRITE-HABIRPRENE CABLE gives unexcelled performance!

To help assure uninterrupted production, modern industrial plants require reliable cables for delivering electric power to production lines. The service reliability of Phelps Dodge *Habirite-Habirprene* is unsurpassed by any other rubber insulated neoprene jacketed type RR cable.

Habirite-Habirprene is a combination of specially engineered butyl rubber insulation and neoprene jacket. The overall features of this cable provide greater resistance to heat, oxidation and ozone; improved electrical properties, including superior insulation resistance; higher copper operating temperature; superior flexibility; improved mechanical toughness against damage from installation hazards and extra resistance to corona, an absolute necessity for high-voltage neoprene jacketed cable.

As a general purpose cable, *Habirite-Habirprene* assures the utmost in safety, durability and reliability.

See Your Phelps Dodge Distributor!

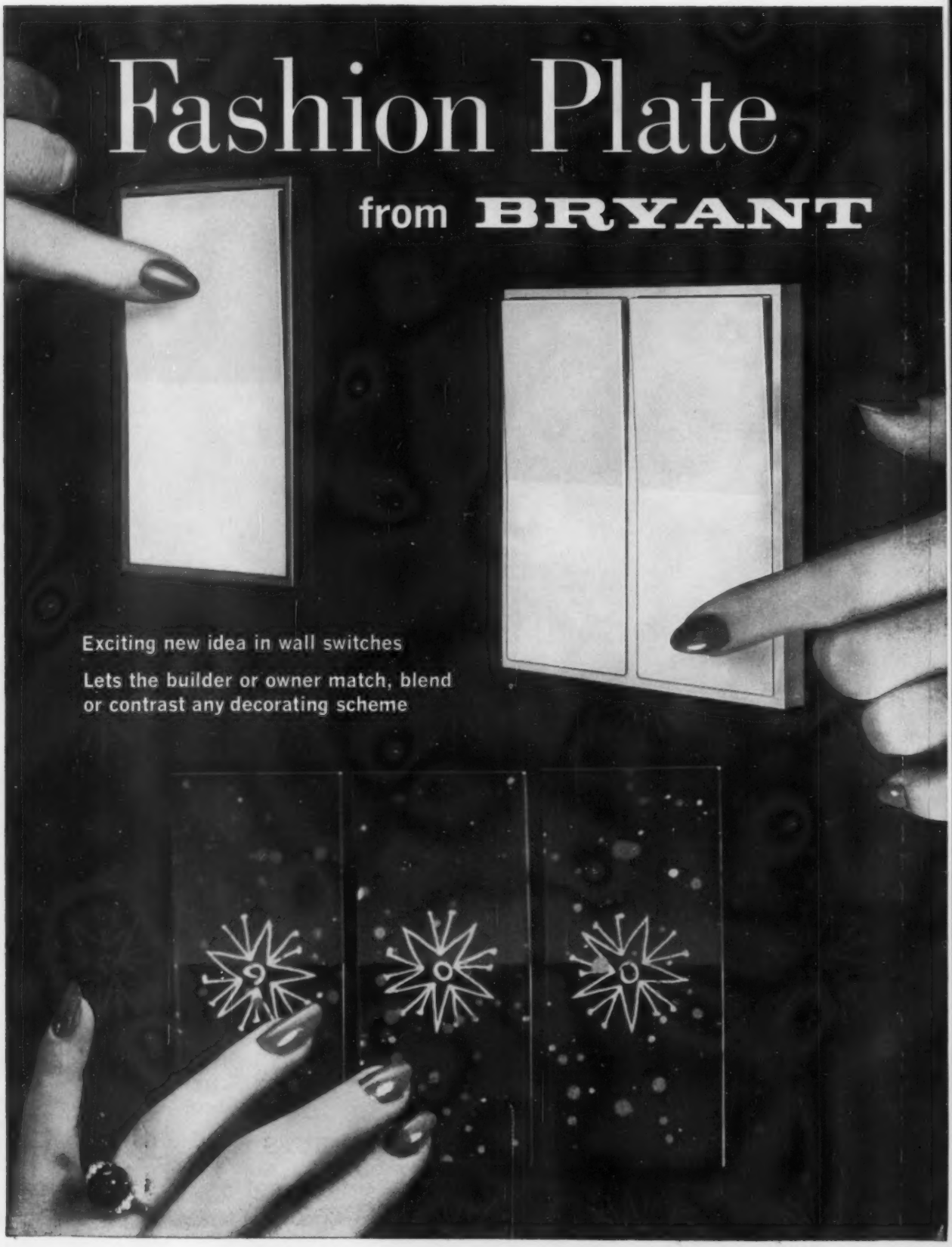
PHELPS DODGE COPPER PRODUCTS CORPORATION

PD

SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Fort Wayne, Greensboro, N.C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D.C.

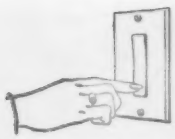
Fashion Plate

from BRYANT



Exciting new idea in wall switches

Lets the builder or owner match, blend or contrast any decorating scheme



TAP-EEZ . . . new tap-action, flush-mounted switch for buildings, institutions and stores. Rugged enough for all a-c applications, yet much more attractive than ordinary switches.

WINS NEW CUSTOMERS . . . CAPTURES MORE BUILDER DOLLARS

Fashion Plate opens the door to more business in new construction . . . for homes, buildings, institutions . . . brings you a bigger share of the total building dollar

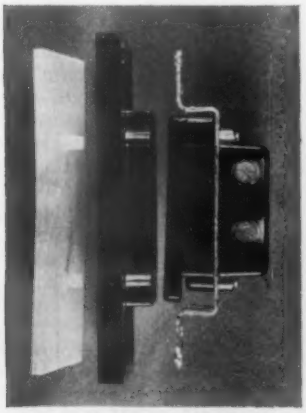
There's real excitement about Fashion Plate* among builders and architects. They are taking a second look at wall switches. That means you'll see Fashion Plate in more and more specifications . . . in more and more new homes and buildings. And you are the one who profits.

Right now, builders all over the nation are being supplied with a brand-new merchandising package for Fashion Plate. And they are being sent to you to supply their wiring needs.

Don't wait. Stock up now before the big building rush this summer. Next job you wire, suggest Fashion Plate. It's an exciting new product that wins customers and builds profits.

*Trade-Mark

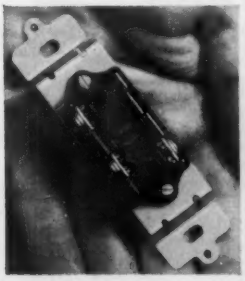
ASK YOUR BRYANT DISTRIBUTOR for a sample of Fashion Plate. Take it apart and see the built-in quality . . . the trade-mark of Bryant superior wiring devices.



Smooth, quiet action. Low installation cost. Just press on back plate and actuator.

UNLIMITED APPLICATIONS—AVAILABLE IN SINGLE, DOUBLE AND THREE GANG COMBINATIONS—WITH CLEAR OR IVORY ACTUATORS, BLACK OR WHITE BACK PLATES

Silver alloy contacts insure long life. Positive controlled contact action. Listed by Underwriters' Laboratories, Inc.



Compact design. Fits standard switch boxes. Requires no special wiring.

Time-saving, clamp-type, back wiring terminals make installation quick and easy.

Fashion Plate

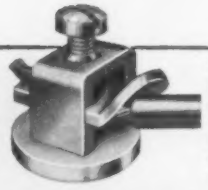
the exciting things come from

BRYANT

THE BRYANT ELECTRIC COMPANY, BRIDGEPORT 2, CONNECTICUT

J-09094

NOW... WIRE RANGES and DRYERS *Faster*



Heavy duty screw staked to clamping pad for quick, positive action of the pad either up or down — Shipped with screws backed out, ready for instant wiring; just insert the conductor and tighten the screw!

EASIER, FASTER, SAFER WIRING!

Surface Mounting	Flush Mounting
Black or Ivory	Brown or Ivory
RANGE: Cat. No. 606 50 Amp-250V	RANGE: Cat. No. 610 50 Amp-250V
DRYER: Cat. No. 607 30 Amp-250V	DRYER: Cat. No. 611 30 Amp-250V
Unit Pack: 1	Unit Pack: 1
Ship. Carton: 10	Ship. Carton: 10

Deluxe Chrome Wall Plates
Cat. No. 316 grounding
Cat. No. 317 non-grounding
Fit standard 2-gang boxes
in individual envelopes,
10 to a carton, 50
to a shipping carton

You save time and trouble on every installation when you use Royal Range and Dryer Receptacles with the exclusive "Vise-Grip" terminals. "Vise-Grip" assures positive connections every time . . . for FULL, NO-ARC power to the appliance.

No receptacles can "out-feature" Royal — with heavy duty, double-wipe spring contacts, sturdy phenolic body, and self-finding slots. Want details? Ask your wholesaler, or write for catalog, giving wholesaler's name.

ROYAL ELECTRIC CORPORATION
PAWTUCKET, RHODE ISLAND

ROYAL ELECTRIC ...an associate of

Ceiling Unit (37)

A new four-way ceiling unit that combines a heater, a circulating fan, a light and exhaust fan. While fan is circulating gently heated air, the exhaust fan automatically shuts off preventing any loss of warm air. Heating element is the enclosed type. A silent exhaust fan quickly carries off all steam and odors. Lens on the 100-watt light is hinged for easy removal and is especially designed to illuminate the entire bathroom. Unit is equipped with a back draft hamper which is flanged for use with standard 4-in. duct.

NuTone, Inc., Cincinnati 27, Ohio

Tap (38)

A mechanical tap for use with aluminum to aluminum, copper to aluminum or copper to copper conductors. Reddy tap is used to make tee or parallel taps or crossovers of either copper or aluminum conductors. Tap comes with contact surfaces coated with cable joint compound which acts against high resistance oxide films on aluminum or unplated copper conductors. It is available in six sizes to accommodate conductor sizes in any combination of main or branch from No. 8 to 500 MCM.

Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.

Textile Motor (39)

Type KZCN textile motor is a completely new polyphase induction motor design, adapted specially for the textile and related industries. It is available at present in the rerated frames 326U and smaller. This totally enclosed fan cooled motor incorporates a unique ventilating system and enclosure as well as special treatment of air passages through which airborne lint is carried. The multi-vaned fan and dual purpose fan-shield allow lint-laden air unrestricted passages without clogging. The fan guard design not

only protects the operator from rotating parts but eliminates the need for air inlet openings or baffles in the end of motor. The conventional type conduit box is available for dual voltage applications.

Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago 5, Ill.

Input Controllers (40)

The new Chromalox input controller, type VCP, is a packaged master control panel for controlling electric input to heating loads where the mass of components and heating system are relatively large. Controller is rated 15 amps at 115 or 230 volts. It is a factory-wired unit in a surface mounting drawn-steel box with a hinged cover. Comes complete with fused disconnect switch, 30-second cycle, 15-amp input controller, indicating lights for line and load and a built-in terminal block. Single phase loads over 15 amps and 3-phase loads require a contactor.

Edwin L. Wiegand Company, 7500 Thomas Blvd., Pittsburgh 8, Pa.

Switches (41)

An improved line of heavy duty break glass switches, rated 5 amps at 250 volts ac or 10 amps at 125 volts ac. Two forms of control switches are listed. The form suitable for ASCO mechanically held remote control switches is a single pole, double throw switch. This is connected to cause the remote control switch to open when the glass is broken. The break glass switch is also connected so that the remote control switch cannot be electrically reclosed until the glass has been replaced. Any number of break glass switches can be connected to operate a single remote control switch. The second form, suitable for 2-wire operated devices such as motor starters or solenoid valves, is a single pole, single throw switch.

Automatic Switch Co., Florham Park, N. J.

for tight spots in shallow ceilings

NEW GUTH
shallow mounting
SRS
INCANDESCENT LIGHTING FIXTURES

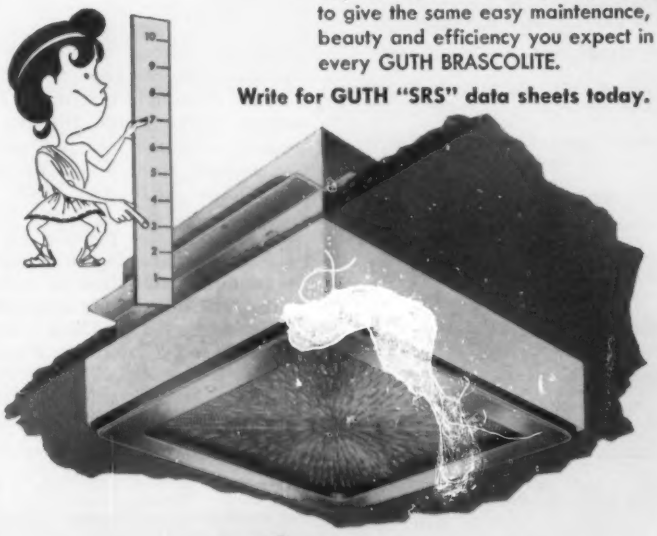
... for shallow-plenum "problem" ceilings in corridors, halls, lobbies, under ducts, pipes—wherever construction limits depth above finished ceiling.

There's room for your imagination to move around in Guth's wide, wide line of Semi-Recessed Shallows!

The GUTH SRS line offers an engineer's choice of more than 25 lens-type variations ... a size and lens for every application.

All SRS fixtures fit 3- or 4-inch mounting depths, and are carefully engineered to give the same easy maintenance, beauty and efficiency you expect in every GUTH BRASCOLITE.

Write for GUTH "SRS" data sheets today.



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THE EDWIN F. GUTH CO.
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PLUGMOLD®
GIVES MORE OUTLETS FOR LESS MONEY

Easy installation on any surface gives lowest-cost way to provide *lots of outlets* wherever desirable. Planning flexibility, simplicity of later additions of circuits or outlets, also help make PLUGMOLD *easy to sell.* Get it from your distributor.

Eliminate situations like this "Plug Puzzler"

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PLUGMOLD 2000 (UP TO 3 NO. 12 CONDUCTORS)

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PLUGMOLD 2200 (UP TO 3 NO. 6; 10 NO. 10)

PLUGMOLD 3000 (UP TO 8 NO. 6; 10 NO. 8)

VARIOUS SIZES AND SPACING. ALL-STEEL, GROUNDED.

ALL PLUGMOLD IN BUFF OR GRAY PRIME COAT

The Wiremold Company, Hartford 10, Conn.
Please send FREE PLUGMOLD DATA to:

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Company

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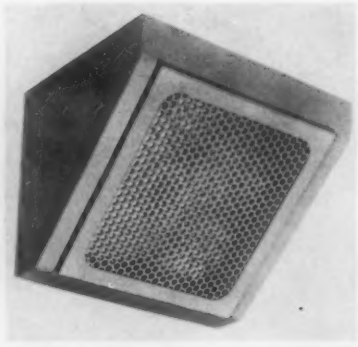


Lighting Unit (42)

The 53-40 line of lighting fixtures is designed to meet the rigid requirements for maximum security areas such as prison cells, psychopathic wards, detention buildings, shelters for delinquent children and other areas subject to re-occurring vandalism. Features are one-piece cast aluminum housing of heat-treated high tensile strength alloy; non-removable 10-gauge perforated steel protective guard having 48% open area over a ¼ in. clear Herculite glass plate and high-stress Holophane Controlens; 150-watt incandescent lamp and specular anodized aluminum reflector. Fixture fits between wall and ceiling, preventing the concealment of tools or weapons.

McPhilben Lighting Inc., 1329 *Willoughby Ave., Brooklyn* 37, *N. Y.*

Enclosures (43)

Cast aluminum alloy explosion-proof and dust tight housing are now available with glass windows for easy reading of instruments and meters. They range through six sizes to accommodate instruments and meters from 3½-in. round to G.E. types AB18 and DB18 and Westinghouse K24 meters. Heavy wall sections also provide for the required five threads of engagement for conduit installation as required by the NEC. Housings are suitable for listing by UL for Class I, Group D and Class II, Groups E, F and G. Bulletin P-3 is available.

Adalet Manufacturing Co., 14300 *Lorain Ave., Cleveland* 11, *Ohio*

Fitting (44)

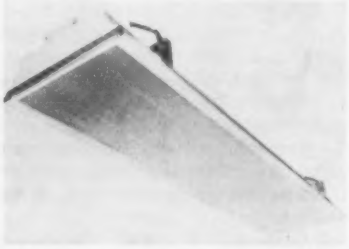
Flexiduct No. 345 consists of six parts; a metal base plate with knockout for underfloor input, a box 4 ins. sq and 1 in. high, a riser and a plug. Box fastens to base plate with two self tapping screws. Riser and plug are interchangeable. No. 345 accommodates either No. 1 or No. 2 Flexiduct with a ¼ in. overlap. This new part will serve as a terminal box, riser, ell, tee, cross, underfloor input, or as a combination of all of these uses. By removing both plug and riser it can serve as an overhead input.

Winders & Geist, Inc., 2219 *N. Cotner Blvd., Lincoln, Neb.*

Gear Drives (45)

Enclosed gear drives to meet the majority of application requirements for speed reduction units 125 hp and smaller, with output speeds ranging from 780 to 1.2 rpm at 1750 rpm input speed, have been announced. Unit-type housings of corrosion resistant cast iron have the output shaft endplate and mounting feet or flange cast as integral parts for strength and rigidity. Foot-mounted, flange-mounted and extended flange straight-line units are available as integral-type gearmotors, with the motor and speed reducer forming an integral assembly.

Wagner Electric Corp., 6400 *Plymouth Ave., St. Louis* 33, *Mo.*



Troffers (46)

A new series of 1- and 2-ft wide troffers, known as Speedomatic, recess 4⅛ ins. and are available in four basic types that fit all of today's popular ceilings. A feature is telescopic door frame, which automatically adjusts to assure perfect fitting, even in irregular ceiling openings. When installed the shielding is framed in ceiling by a single width of metal. Wiring access door offers ample room to reach BX, Greenfield or other cable and attach to plate after fixture is in ceiling. Other features include large end openings for continuous wiring; integral mounting brackets with no loose parts; rotating door frame end caps that permit replacement of shielding by turning only one fitting; and fast travelling double lead screws that level troffer to ceiling line in seconds from below.

Smithcraft Lighting, Chelsea 50, *Mass.*

Broadway Maintenance figures costs closely

. . . but doesn't take chances!

THE Connecticut Turnpike is the world's longest illuminated highway, and a new concept in highway travel... a highway as safe to drive by night as by day. Illuminating the Turnpike required 3500 mercury-vapor luminaires. Broadway Maintenance's part of the lighting contract was $1,250,000. The electrical connectors accounted for only $1,000. How much of this $1,000 could be cut? Not enough to take chances on the quality of the connector and performance of the system. Broadway Maintenance didn't take chances—they installed Burndy connectors.

For over 30 years, contractors have depended on Burndy connectors to do the job right without taking chances.

"In my 30 years of electrical construction work, it has always been important to me to have a single source of supply. I use Burndy because they have the largest line of quality connectors in the business."

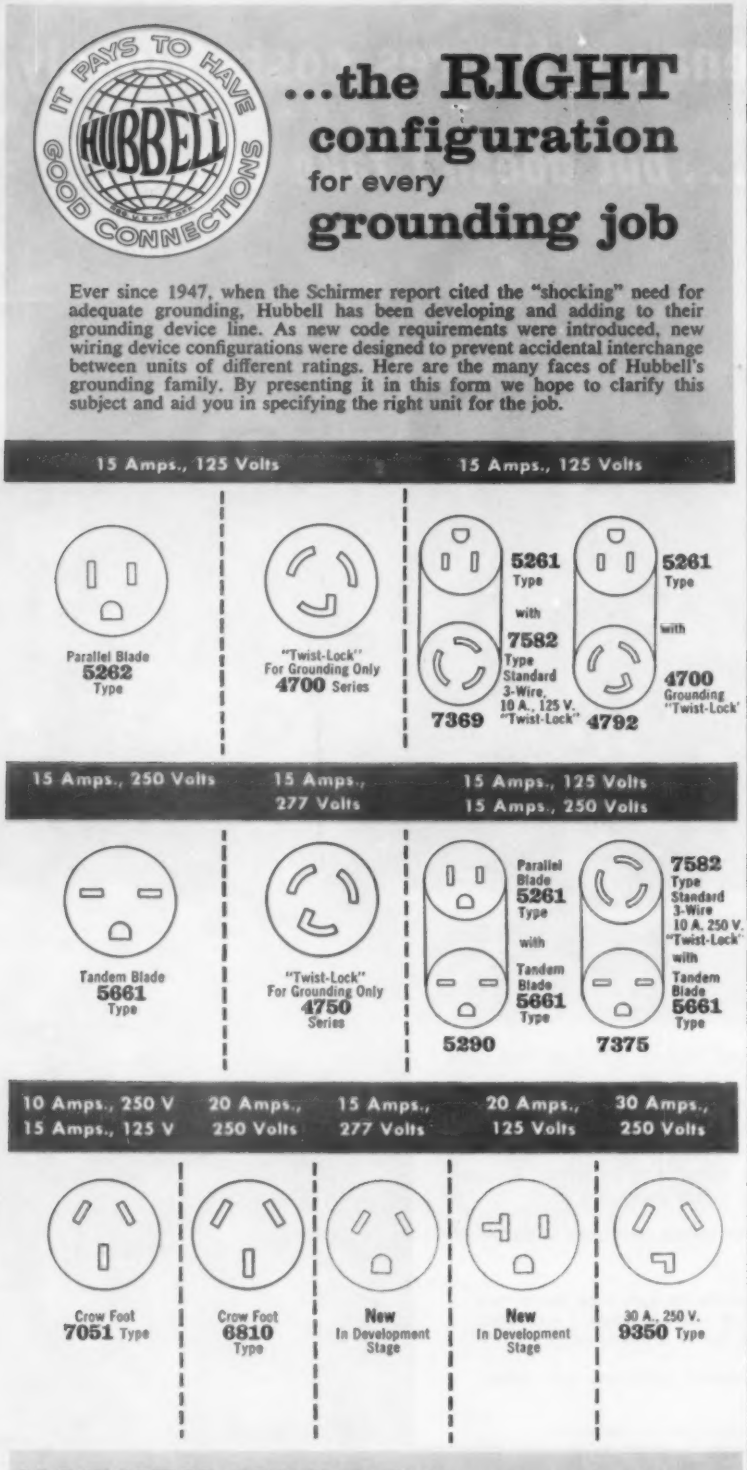
Gilman Hallenbeck, General Superintendent, Light & Power Div., Broadway Maintenance Company, New York.

Connecticut Turnpike, Broadway Maintenance Company, electrical contractor

BURNDY

ELECTRICAL CONNECTORS

Norwalk, Conn. · In Europe: Antwerp, Belgium · Toronto, Canada


IT PAYS TO HAVE
HUBBELL
GOOD CONNECTIONS
...the RIGHT configuration for every grounding job
Ever since 1947, when the Schirmer report cited the "shocking" need for adequate grounding, Hubbell has been developing and adding to their grounding device line. As new code requirements were introduced, new wiring device configurations were designed to prevent accidental interchange between units of different ratings. Here are the many faces of Hubbell's grounding family. By presenting it in this form we hope to clarify this subject and aid you in specifying the right unit for the job.
15 Amps., 125 Volts
15 Amps., 125 Volts
Parallel Blade 5262 Type
"Twist-Lock" For Grounding Only 4700 Series
5261 Type with 7582 Type Standard 3-Wire, 10 A., 125 V. "Twist-Lock"
7369
5261 Type with 4700 Grounding "Twist-Lock"
4792
15 Amps., 250 Volts
15 Amps., 277 Volts
15 Amps., 125 Volts
15 Amps., 250 Volts
Tandem Blade 5661 Type
"Twist-Lock" For Grounding Only 4750 Series
Parallel Blade 5261 Type with Tandem Blade 5661 Type
5290
7582 Type Standard 3-Wire 10 A. 250 V. "Twist-Lock" with Tandem Blade 5661 Type
7375
10 Amps., 250 V 15 Amps., 125 V
20 Amps., 250 Volts
15 Amps., 277 Volts
20 Amps., 125 Volts
30 Amps., 250 Volts
Crow Foot 7051 Type
Crow Foot 6810 Type
New In Development Stage
New In Development Stage
30 A., 250 V. 9350 Type
HARVEY HUBBELL, INCORPORATED
BRIDGEPORT 2, CONNECTICUT
WIRING DEVICE OFFICE AND WAREHOUSE LOCATIONS
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Los Angeles 12, California 103 North Santa Fe Avenue
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IN CANADA: Scarborough, Ontario, 1160 Birchmount Road

Transformer (47)

New standard line of sinusoidal constant voltage transformers designed for use with electrical and electronic equipment requiring regulated input voltage having characteristics of a commercial sine wave—especially where harmonic-free output was required. They automatically and continuously regulate output within plus or minus 1% for line voltage variations of plus or minus 15%. Regulators are available in nine stock output ratings from 60 va to 7500 va. They have a current-limiting characteristic that protects against shorts on the load circuit. They are available in step-up and step-down ratios allowing substitution for conventional, non-regulating transformers.

Sola Electric Co., 4633 *W. 16th St., Chicago* 50, *Ill.*

Product Briefs

(48) A new ac powered balanced line intermixed **intercom system**, the "Mascofone," has been announced by the Mark Simpson Manufacturing Co., Inc., 32-29 49th Street, Long Island City 3, N. Y. . . . (49) Four different AWG wire sizes are being offered by Chester Cable Corp., Chester, N. Y., in a new line of submersible **pump wire** for installation in artesian or other deep wells.

(50) A 30-minute synchronous motor-driven **timer** is being offered by Cutler-Hammer, Inc., Milwaukee, Wis. . . . (51) New 1959 Mobilite, a trailerized **floodlighting unit** that generates its own electric power, has been announced by Pacific Mercury Co., 14052 Burbank Blvd., Van Nuys, Calif. . . . (52) Development of an electronically controlled self-regulating distribution **transformer** has been completed by Line Material Industries, Milwaukee 1, Wis.

(53) Announcement has been made by the Certified Electric Corp., Warren, Pa., of a new pure white fluorescent **lamp**, known as "Koolorated". . . . (54) General Electric Co., Schenectady 5, N. Y. has introduced a new 13.2 kv butyl-molded, hook-on current **transformer** extending applications of G-E's portable CH-7 and CF-7 hook-on recording volt-ammeters. . . . (55) Penn-Union Electric Corp., Erie, Pa., has announced the completion of their line of crimp **connectors**, "Penn-Crimps," to include all sizes from No. 22 to 2,000,000 CM.

Catalogs & Bulletins

(56) WELDERS. Bulletin 4608.1 describes operating features, construction details and applications of new line of welding machines. 6 pages. Automatic Switch Co.

(57) FAN MOTORS in ratings of 1 to 125 hp, enclosed and explosion-proof, are covered in 4-page Bulletin 2950, which includes dimensions and data on fan weight, thrust and location. Louis Allis Co.

(58) MAGNETIC CONTACTOR. Bulletin GEA-6803A, 2 pages, describes new 3ARR-8 magnetic line contactor for air conditioning applications. General Electric Co.

(59) POWER CABLE. 32-page Catalog 102 covers Butyl (AB) cable for wide range of power requirements from 600 to 15,000 volts. Anaconda Wire & Cable Co.

(60) CAPACITOR MOTORS from ½ to 15 hp in frame sizes from 56 to 286U for applications requiring an exceptionally rugged motor are described in Bulletin SDA 145. Peerless Electric Co.

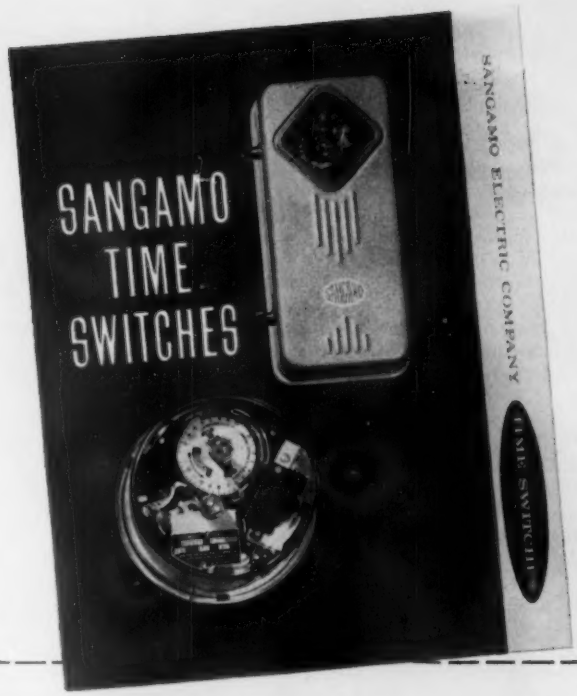
(61) CIRCUIT BREAKERS. Bulletin S-4261-2B is designed to aid in the selection of Urelite individually enclosed low-voltage power circuit breakers rated at 600 volts in 225- to 4000-amp frame sizes. 8 pages. I-T-E Cricuit Breaker Co.

(62) STREET LIGHTING. Bulletin GEA-6989, 12 pages, illustrates how several cities met the challenge of poorly lighted downtown streets, including brief application data with "before" and "after" photos. General Electric Co.

(63) RECTIFIERS. Three new bulletins describe and illustrate new general industrial silicon, germanium and selenium rectifiers ranging in voltage from one to 500 and in amperage from 25 to 12,500. Hanson-Van Winkle-Munning Co.

(64) FLOODLIGHTS. Pocket-sized Bulletin 2714, 184 pages, presents data on selection of floodlights, searchlights, underwater lighting and poles. Crouse-Hinds Co.

(65) VARIABLE TRANSFORMERS. 8-page bulletin P159 describes line of Powerstat 10B series, single and three phase. Superior Electric Co.



Every Electrical Contractor should have this complete guide for TIME SWITCH applications

Here's the new Sangamo reference guide, specially designed to help you save time in selecting the proper features and enclosures for all your time switch applications.

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All product sheets are punched for your catalog, or as an added feature, you may keep them in the handy Sangamo time switch file folder shown above.

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SANGAMO ELECTRIC COMPANY
Springfield, Illinois

NAME_____

COMPANY_____

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CITY & STATE_____

ST59-1 EC

(66) RESIDENTIAL LIGHTING. More than 500 separate items are cataloged in new style book, 200 of which are being presented for the first time. 96 pages. Lightolier, Inc.

(67) REFERENCE TABLE of conversion factors for engineers and other executives in wall chart form includes conversions such as inches to centimeters and watts to horsepower as well as many others. Precision Equipment Co.

(68) CONDUIT FITTINGS. Bulletin 2000 contains new complete listings of Unilets and their accessories. Appleton Electric Co.

(69) BATTERY TECHNOLOGY handbook GB-1896, 36 pages, gives technical instructions and engineering data on the care of motive power storage batteries. Gould-National Batteries, Inc.

(70) ELECTRICAL CONNECTORS. 8-page Bulletin PR 259 describes solderless Supercon molded plastic connectors in 50- and 100-amp capacities for plug-in power switchboard patching applications. Superior Electric Co.

(71) LIMIT SWITCHES for use in safety interlock systems to tie together two or three functions without an additional relay or to control a motor and simultaneously start or stop a timer or other control are described in 1959 general catalog. R. B. Denison Mfg. Co.

(72) FUSES. High-voltage current-limiting Fusistors for protecting potential transformers, small service transformers, control transformers and auxiliary power transformers are described in Bulletin 281, 4 pages. S&C Electric Co.

(73) THERMOSTATS. 4-page Bulletin GED-3585A gives complete information on room thermostats for heating and cooling applications. General Electric Co.

(74) TUBULAR HEATERS. Bulletin GER-1563, 4 pages, gives rules and procedures for simplifying the problem of fitting a tubular heater to the object to be heated, with a description of bending methods. General Electric Co.

(75) VARIABLE-SPEED DRIVES in variety of modifications for horizontal or vertical use are described with detailed information on remote controls in Bulletin 195. Sterling Electric Motors, Inc.

(76) DISTRIBUTION EQUIPMENT. 68-page illustrated catalog contains complete descriptions, buying and design specifications on circuit breakers, load centers, safety switches, fusible service and meter mounting equipment. Murray Mfg. Corp.

(77) PORTABLE TESTER for periodic testing of oil circuit reclosers is described in 8-page Bulletin SB-OCR-1. Multi-Amp Corp.

(78) POLYPHASE MOTORS from ½ to 30 hp in frame sizes from 56 to 326U, open drip-proof, totally enclosed, fan-cooled or explosion-proof, are described in Bulletin SDA 105. Peerless Electric Co.

(79) PHOTORELAY designed for such purposes as controlling outdoor lighting in cities and on farms, counting and sorting in factories, and sounding safety alarms is covered in data sheet. Berkeley/Dynamics.

(80) TROFFERS. 20-page catalog details complete price and ordering information on all recessed fluorescent lighting equipment. Smithcraft Lighting.

(81) MATERIALS HANDLING equipment including lift trucks, rider tractors, and manual equipment is described with specifications and illustrations. Catalog 80-204, 16 pages. Lewis-Shepard Products, Inc.

(82) WIRING and wiring system standards for industrial use, including automation, conduit systems, troughs, trays, ladders, bus ducts and other new products and wiring methods are discussed in Bulletin RCT-102. Rome Cable Corp.

(83) TIMERS. Bulletin GEA-6804, 2 pages, describes AMT-1 series of clock and interval timers for gas and electric ranges. General Electric Co.

(84) TRANSFORMERS. Catalog TR-60 lists complete industrial transformer line, including such new products as micro-miniature transformers and transformers for transistor applications. Triad Transformer Corp.

(85) IMMERSION HEATERS. Bulletin GEA-6305A, 2 pages, comprises handy selector guide for water, alkaline or plating-bath heating. General Electric Co.

(86) INDUSTRIAL BATTERY servicing. 48-page general service manual details the operation and maintenance, of Sylver-Clad motive power batteries. C&D Batteries, Inc.

(87) PORTABLE LIGHTING for oil and gas derricks, masts and associated areas is covered in Bulletin B75. Joy Mfg. Co.

(88) FAN CONTROLS. Bulletin GEA- 6577A, 2 pages, describes ¾-hp gas or oil fan and limit controls for furnace applications. General Electric Co.

(89) TV SYSTEMS. Series of catalog sheets and specification folders comprise TV systems bidder's guide enabling any bidder to write a complete specification. Blonder-Tongue Laboratories, Inc.

(90) SERVICE CAR for bowling alleys, with power supplied by trolley busway electrification system, is described in Bulletin 74. Feedrail Corp.

(91) TIMING DEVICES. 4-page brochure produced for the design engineer gives a short review of numerous mechanical timers, time switches and time delay relays. M. H. Rhodes.

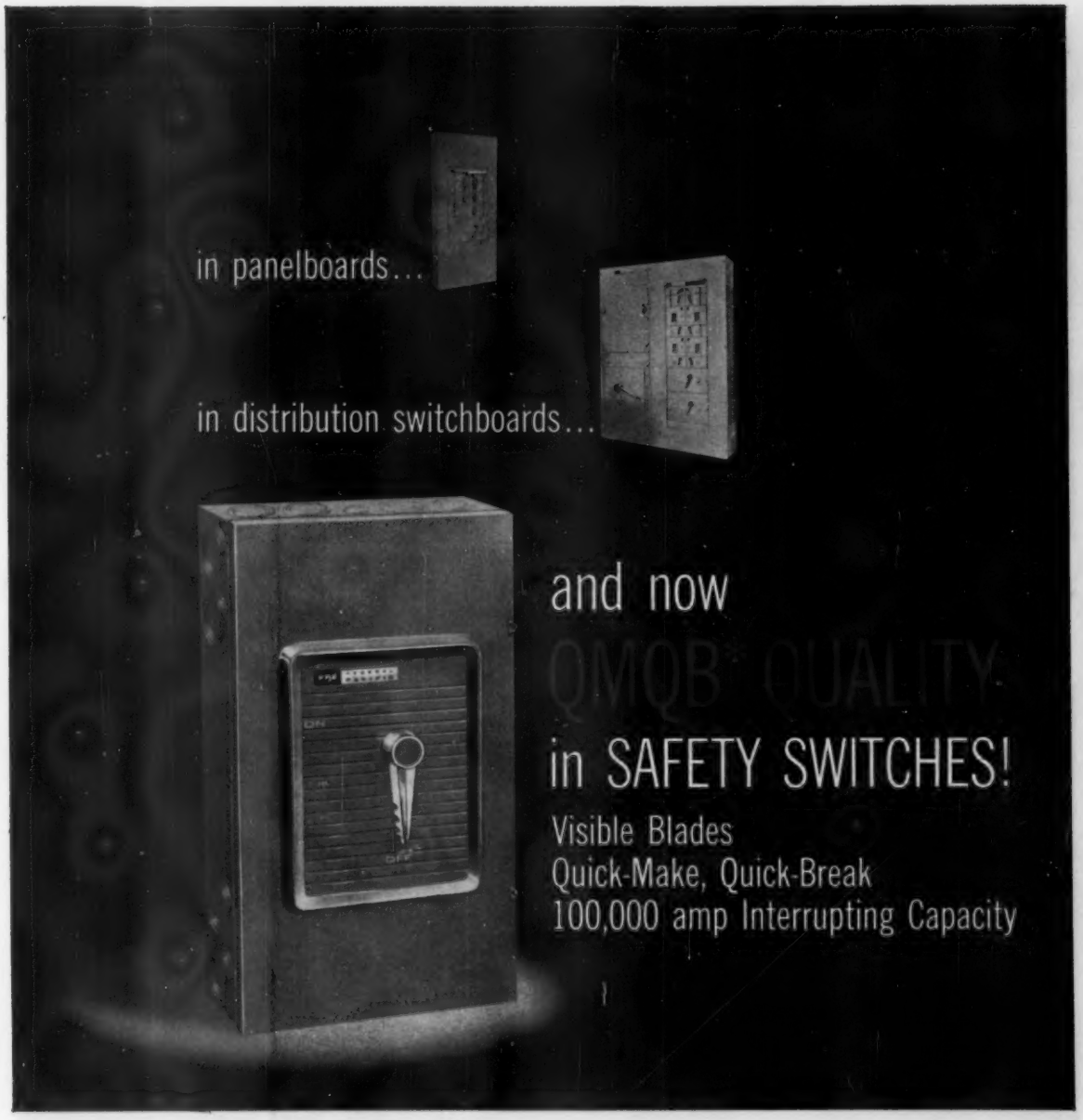
(92) RECTIFIERS. Revised catalog, 8 pages, gives information on Selenium Slims high-voltage, cartridge-type rectifiers, with dimensional outlines and circuit diagrams. Syntron Co.

(93) POWER TRANSMISSION and tower design trends are covered in 4-page Bulletin 2570, with description of anchoring systems. Blawknox Co.

(94) STORAGE BATTERIES. New line which boosts work capacity of industrial trucks by as much as 45% is described in technical bulletin Form 6230. Exide Industrial Div., Electric Storage Battery Co.

(95) CONCRETE FLOOR. 6-page brochure describes how Port Columbus Airport in Columbus, Ohio, used precast concrete floor and roof units to provide electrical flexibility. Flexicore Co., Inc.

(96) UNITIZED MOTORS. 12-page Bulletin GEA-6882, with inserted 4-page technical data bulletin, discusses features and basic advantages of 4-pole, 59-frame, shaded-pole and permanent-split capacitor motors. General Electric Co.



✻ QUICK-MAKE, QUICK-BREAK ACTION—QMQB Safety Switches are tease-proof! Once handle passes midpoint, QMQB mechanism takes over—drives contacts home quickly and accurately in less than one cycle. Longer contact life...cleaner contacts...positive connections...cooler, more reliable performance.

■ 400 amp THROUGH 1200 amp—Normally assembled to take single fuses on 400 amp and 600 amp ratings...parallel 400 amp fuses on 800 amp switch...parallel 600 amp fuses on 1200 amp switches. Available soon —800 amp and 1200 amp ratings designed for single fusing.

■ VISIBLE BLADES FOR MAXIMUM SAFETY—Eliminates any doubt as to whether switch is "ON" or "OFF" and provides for easy inspection.

■ LEVER-TYPE HANDLE ACTION FOR EASY SWITCH OPERATION—Requires less than 60° throw to operate interlock and switch mechanism. For added safety: large, rugged handle indicates switch position...can be clearly seen from a distance.

■ DEIONIZING ARC QUENCHERS FOR COOLER, FASTER INTERRUPTION—Arc is drawn from contact...broken into segments by grids...cooled and extinguished before any damage can be done.

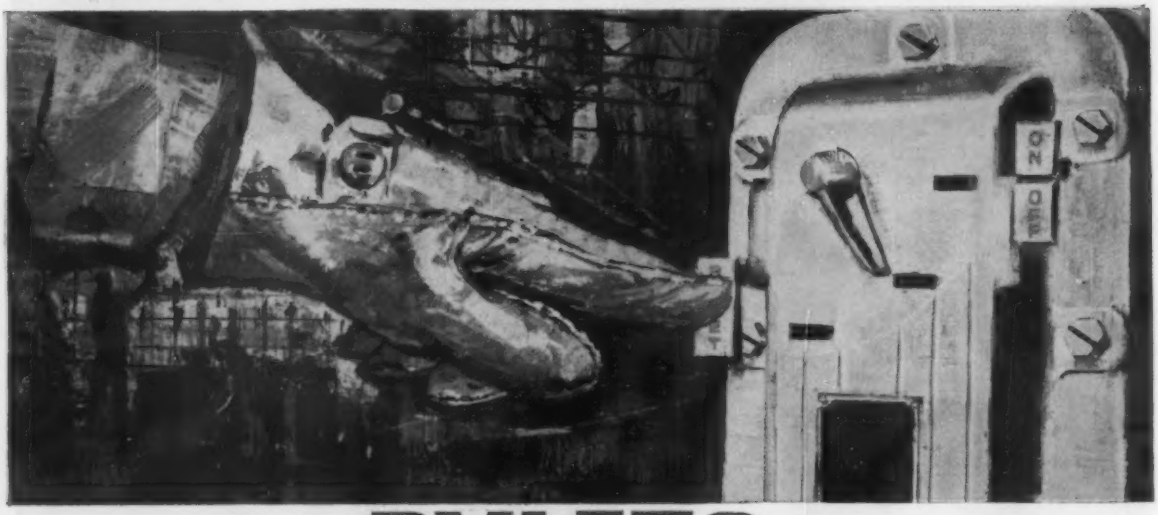
■ HIGH PRESSURE FUSE CLIPS FOR LONG LIFE, DEPENDABLE SERVICE —Belleville washers apply constant pressure against the fuse and hold it in a vise-like grip. Low resistance contact...cooler, more efficient operation.

Now...by applying its proven QMQB concept to heavy duty safety switches ...Federal Pacific makes a major advance in the economical handling of Industry's increased power requirements. For complete details of QMQB Safety Switches write for Bulletin #1280, Federal Pacific Electric Company, General Offices: Dept. 371, Newark 1, New Jersey.

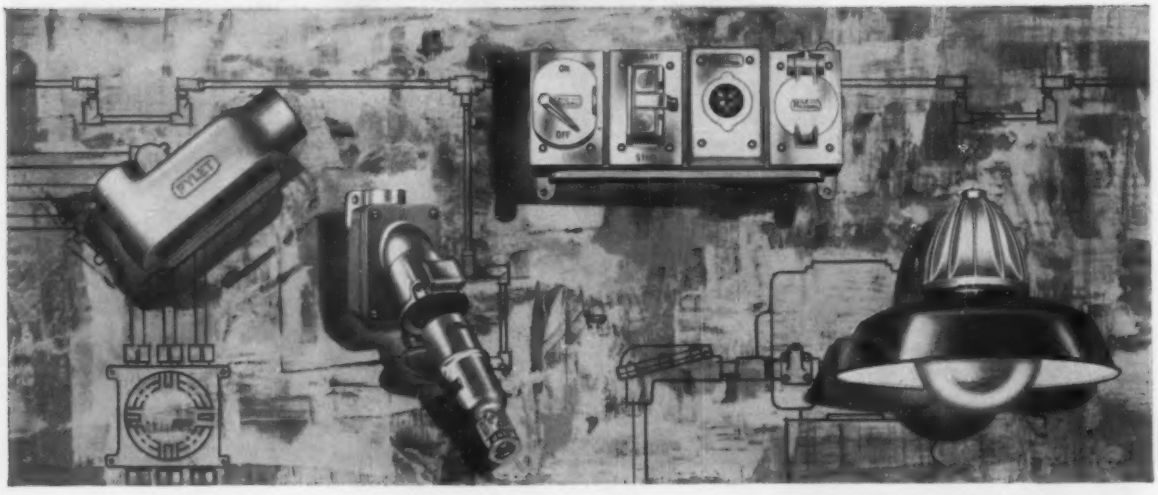
FPE **FEDERAL PACIFIC ELECTRIC COMPANY**

The Best in Electrical Distribution and Control Equipment

For protection of wiring and equipment



you can rely on PYLETS®



PYLET conduit fittings, circuit controls, lighting fixtures and connectors are second to none for quality and dependable service.

Built-in, environment-resistant features exceed code requirements, to meet the exacting demands of industry today—for both hazardous and non-hazardous locations. Cast metal fittings with taper tapped hubs, smooth roomy interiors and cadmium plating insure economical installation and maintenance as well as long service life.

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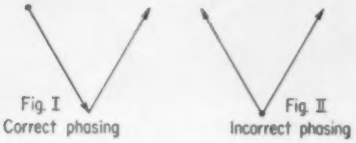
Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Heater Connected to 3-Phase Open Delta Supply

QUESTION H36—Recently we installed an electric heating element connected 3-phase delta. The power supply is from two transformers connected open delta. The current in two phases is 28 amps and in one phase, 12 amps. Are all open delta connections this far out of balance? If so, why?—H.G.R.

ANSWER TO H36—When connecting open delta transformers the phasing on these transformers is extremely important. A sketch shows that one of the transformers in the open delta was improperly phased so that the voltage between the two outside legs of the transformer is not the same as the voltage between the other legs. In other words, the phase voltages are not balanced out.—H.H.S.



ANSWER TO H36—An answer to this question could better be given if the capacity of the transformers and heaters were given.

In the first place when the "V" connection is used, the load must be only about 57% of what it could be if three transformers were used.

If three transformers were used you would choose them to equal the capacity of the load. Then if one transformer is removed the current in the remaining transformers would increase to 1.73 times the former current value, causing much greater losses and drop in voltage in the line and the primary and secondary coils and deliver a lower current reading in one line. To overcome overloading of the two transformers they should have a capacity 15.5% greater than when three transformers are used. If transformers weren't chosen on this basis, it would be one reason for the low current reading in one line.

I would check the voltage and wattage of the heaters to be sure your load is balanced.

A much better connection of two transformers for three phase operation to overcome some of the disadvantages of the "V" connection, is the "T" connection. The primary and secondary of one transformer must have a middle tap. Connect one transformer primary to the line. Connect one lead of the second transformer to the middle tap of the first transformer and the other lead to the third line wire.

For a perfect setup, the transformer connected to the middle tap, should deliver a voltage 86.6% of the voltage of the other transformer. However, if both transformers have the same voltage the performance is better than obtained with the "V" connection.—B.A.S.

Installing Bearings on Motors

QUESTION J36—There are differences of opinion on installing bearings on motors. Some say heating in oil is proper, while others believe in using a press. We have used a cone heater to expand the inner race until it will slip on the shaft. Then it is left to cool. This procedure has been used for years. Does anyone have any other ideas?—E.S.H.

ANSWER TO J36—The press system will scratch the shaft but cannot carbonize or otherwise get the bearing dirty. The press cannot be used all over due to local conditions.

At times we pack dry ice on the shaft, then we heat the item that is forced on the shaft.

For most jobs any system is O.K. Chemical fumes, extra hot, and extra cold conditions can force us to change our methods.—H.S.

ANSWER TO J36—Before the question of "press vs heat" can be answered, consideration must be given to the type of bearing used.

In the case of the sealed prelubricated bearing, temperature that exceeds the melting and dropping point of the grease should not be used.

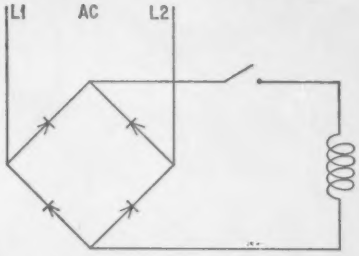
In the case of the open type bearing, heat in any form will expedite bearing installaton. We use the press fit in all cases with an end result of speed; no time is lost in the heating operation.

Finally, with current bearing tolerances, heat is unnecessary.—J.A.M.

Comment

Question M35 of our April issue was as follows:

"We have had to replace quite a few rectifiers for an electric brake wired as shown in the diagram.



Would a discharge resistor across the coil remedy our trouble, or would it be advisable to connect the switch in the ac line instead of the dc side of the rectifier as it is now? —J.J.L.

Two answers published suggested operating the circuit in the ac line. This inspired a letter from a reader pointing out that if this were done a long time delay could occur between opening the ac line and setting the brake.

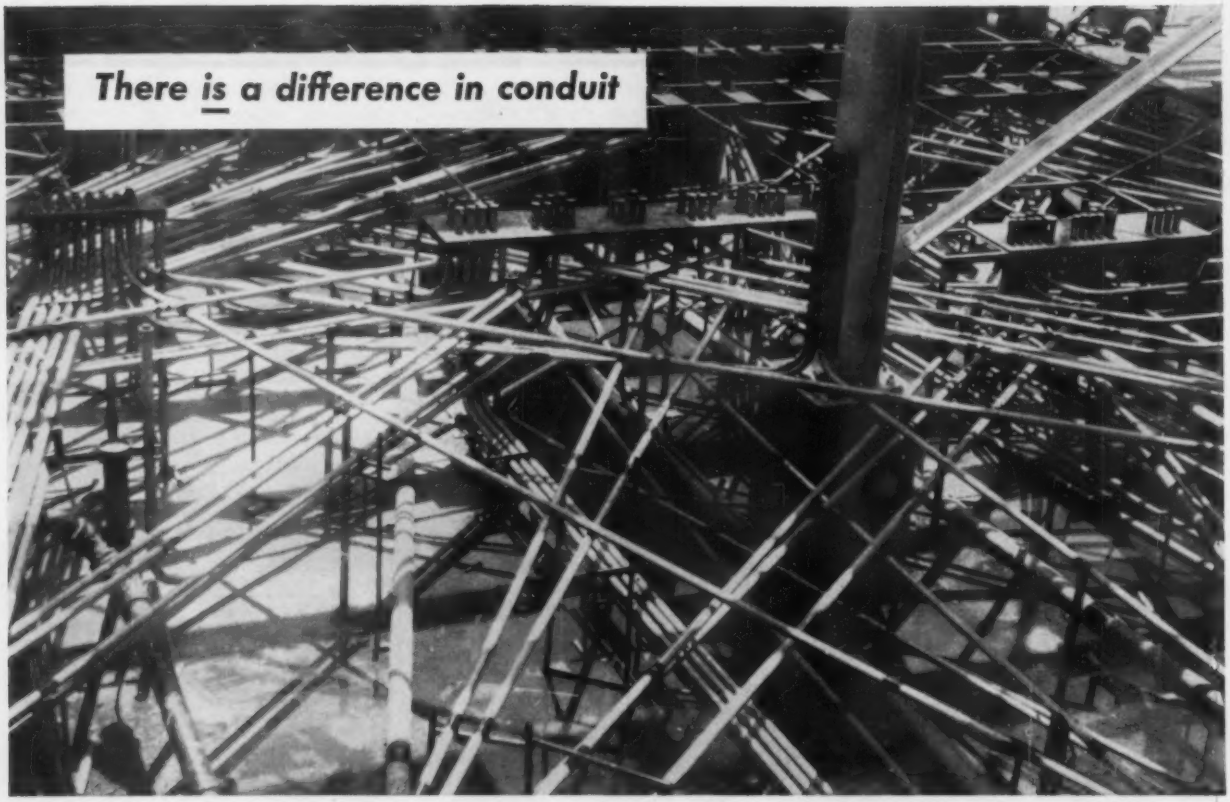
We are advised by a brake design engineer that a typical 240-watt spring set brake would set in about .08 seconds if the above circuit were opened in the dc position. It would take about 2 seconds to set if only the ac line were interrupted.

If rapid brake action is required, therefore, the circuit should be opened in the dc line. If longer delays are tolerable, it may be opened in the ac supply line. If both rapid action and ac line control is desired, an ac operated contactor should be used to switch the dc portion of the circuit.

In general the following considerations should be observed:

1. The brake coil and rectifier should be of the proper size and rating for the braking required on the motor under consideration.

2. Selenium and similar contact rectifiers are resistance devices, and



1) STRENGTH IS IMPORTANT: Even when installed in a concrete slab, conduit must have the strength to replace structurally the concrete is displaces. Because it is made of steel, G-E WHITE GALVANIZED conduit maintains its strength — will not deteriorate in concrete containing anti-freeze or accelerators . . . can be placed in direct contact with reinforcing rods without fear of electrolytic corrosion.

With all the talk about what type of conduit to use . . . here are the facts on

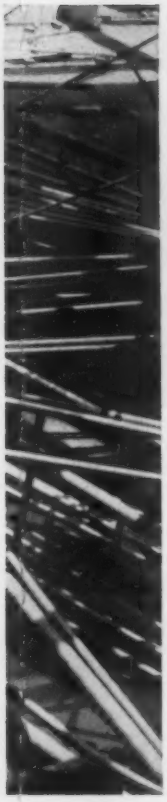
WHY IT PAYS TO USE G-E WHITE

As you know, the first job of conduit is protection. This is one important reason why it pays to use G-E WHITE GALVANIZED steel conduit. In the first place, G-E WHITE GALVANIZED conduit is made of steel . . . and steel is the ideal material to protect electrical conductors from physical harm and guard buildings from damage in case of cable failure. G-E WHITE GALVANIZED steel conduit also gives you top-notch corrosion protection thanks to the special galvanizing process which bonds a uniform coating of hot zinc over every square inch, including the threads. Wire pulling is easier with G-E WHITE GALVANIZED, too, because of the smooth, anti-friction interior coating.

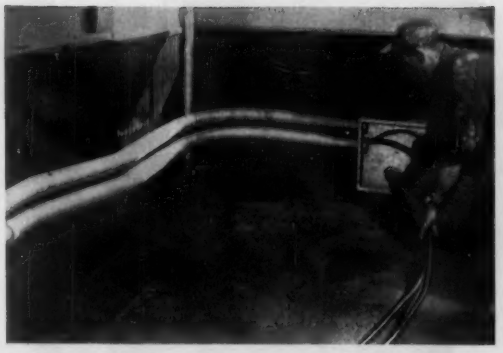
You can use G-E WHITE GALVANIZED steel conduit under conditions that can adversely affect

Progress Is Our Most Important Product

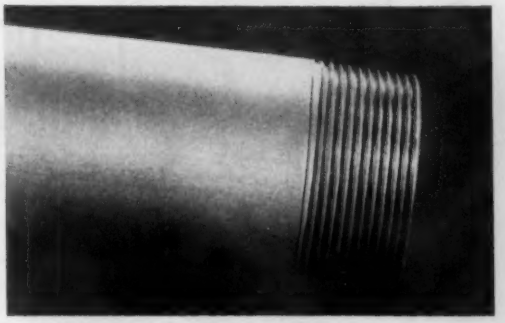
GENERAL ELECTRIC



2) NO SPECIAL HANDLING REQUIRED: Because G-E WHITE GALVANIZED steel conduit resists physical damage, it does not require "kid gloves" handling on the job. You do not have to take special care in cutting, threading or bending as is the case with some conduits made of metal other than steel. G-E WHITE GALVANIZED can be cut with a pipe cutter, threads cleanly without special dies or methods, and bends smoothly without kinking, flattening, or marring.



3) EASY WIRE PULLING: Tough, durable G-E WHITE GALVANIZED steel conduit has a hard, smooth interior surface that resists gouging or hang-ups during fishing and wire pulling. Heavy pulls will not score the inside radius of elbows and bends. Furthermore, the interior of G-E WHITE GALVANIZED conduit is coated evenly with a corrosion-resistant paint containing a special anti-friction agent that results in up to 14% easier wire-pulling.



4) ZINC-PROTECTED THREADS: Threads stay clean and rust-resistant before and after installation because they are hot zinc-coated just like the rest of G-E WHITE GALVANIZED conduit. Because G-E WHITE GALVANIZED conduit is made of steel, the threads do not have to be lubricated to prevent them from "freezing" to the coupling . . . metal is joined direct to metal to give required ground continuity.

GALVANIZED STEEL CONDUIT

some conduits made of metal other than steel. With G-E WHITE GALVANIZED steel conduit you don't have to worry about installations next to dissimilar metals, or in concrete mixes containing additives, or outdoors on absorbent materials. Regardless of the installation conditions, G-E WHITE GALVANIZED does not require any specialized installation methods.

The pictures on these pages illustrate just some of the factors you should consider before making your next conduit purchase. G-E WHITE GALVANIZED is rigid steel conduit at its best — proved in countless installations under the most exacting conditions.

For an informative booklet containing complete product information and useful data tables, send the coupon today.

To: GENERAL ELECTRIC COMPANY
Conduit Products Department
Section C89-818
Bridgeport 2, Connecticut

Please send me your bulletin on G-E WHITE GALVANIZED conduit

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

WHY settle for an ordinary voltage tester?

Ask yourself these questions	The AMPROBE Junior	ordinary voltage tester
Does it measure current as well as voltage?	YES	NO
Does it give you full visibility on a graduated reading scale?	YES	NO
Does it fit conveniently in your pocket?	YES	YES
Does it measure within ±3% accuracy?	YES	NO
Does it come in a full line of models to meet different problems?	YES	NO
Does it protect you against shorts and shocks?	YES	YES
Does it balance loads, locate grounds, determine motor overloads, check rating of circuit breakers?	YES	NO

The AMPROBE Jr. gives you so much more... not just a run-of-the-mill voltage tester but a precision-made instrument that measures voltage *and* current instantly and accurately without shutting down equipment. All this with one rugged and inexpensive pocket-size tool! And now...FOR THE FIRST TIME...at the request of utilities, industrial plants and other large-scale users of AMPROBES, the AMPROBE Jr. has gone SAFETY YELLOW to conform with standard safety practices.

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FATHER AND SON, George A. Yineman (left) and George C. Yineman, combine experience and talents to head Ace Electric Co., Minot, N. D., contracting firm. George, Sr., was former chief electrical inspector for the state of North Dakota.

as such, must be installed so that all accumulated heat will be dissipated by natural convection cooling, or by interlocked fan control. The rectifier units should not be operated in ambient temperatures exceeding 40° C (104°F).

3. If it is essential that the brake operate quickly when the circuit is opened, the disconnection of the brake circuit should be accomplished on the dc side of the rectifier. Disconnection on the ac side will increase the time delay in releasing the brake. This time delay will increase with the rating of the magnetic brake.

4. Overcurrent protection provided on the dc side of the rectifier will open faster in case of a short-circuit across the brake coil, than protection installed on the ac side.

5. To reduce the current from the rectifier to the brake coil, it is desirable in arranging the circuit to place a resistor in series with the brake coil, a second or two after the coil is energized. This may be accomplished by a dashpot timer or condenser-discharge type timing relay. The brake coil requires considerably more current to release than to hold released. After the brake is released the voltage may be reduced to approximately 70% through the resistor. This increased resistance will decrease the current flow through the rectifiers, lower the operating temperature of the rectifier, and reduce arcing at the dc switch contacts.

6. A resistor and capacitor in series, if used, should be placed on the line side of the switch contacts (dc supply) through a normally closed contact, unless time delay in

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setting the brake is not objectionable.

7. Any resistance and/or capacitance circuit, or short circuit placed across the brake coil when the circuit is disconnected will increase the time delay in setting the brake.—J.H.W.

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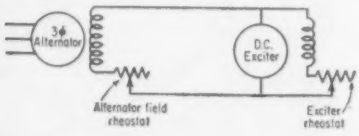
QUESTION S36—In designing a fluorescent lighting system, a question has been raised as to the economy of switching lights off during the lunch period.

A number of contradictory ideas were presented, but all agree on the point that starting voltage of the fluorescent lamp would have to be determined to solve the problem. Since data consulted did not yield enough information, could you advise me of a method of calculating this starting voltage?—R.M.

QUESTION T36—In our plant we have a 3-wire delta, 220-volt ungrounded distribution system. We need some device or means of detecting accidental grounds as we are unable to do so at present without disconnecting our power, area by area; and this is undesirable. Can someone suggest a solution to our problem?—J.A.M.

QUESTION U36—Where can I obtain information on electric band heaters, and pipe tracing cable approved for use in Class I, Groups C & D areas? The proposed application is melting solid pack metallic sodium in 55-gallon drums, and piping to reactor tank.—A.G.C.

QUESTION V36—We have a 13.2-kv, 3-phase, 2500-kw alternator that has a direct-connected exciter. The field rheostat gives off a lot of heat that is nothing but loss. It has



been suggested that this rheostat be eliminated and the field controlled entirely by the exciter voltage which is varied by the exciter rheostat. Is this practical?—H.G.R.

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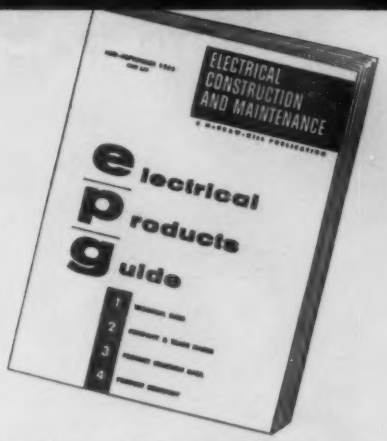

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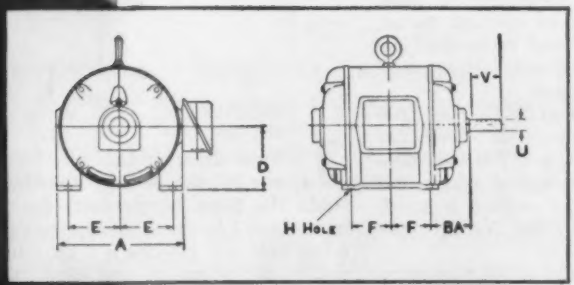
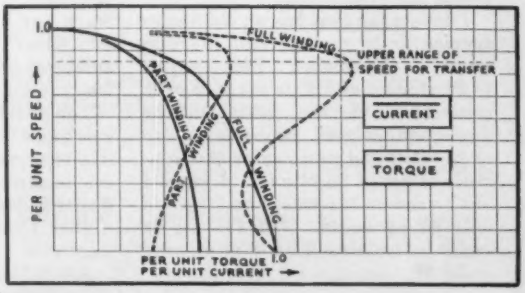


TYPICAL 30 HP part-winding start motor dimensions

Frame Size	Key	A	BA	D	E	F	H	U	V
SC 326U	½ x ½	16	5¼	8	6¼	6	21/32	1⅞	5⅜



SPEED-TORQUE curves show how transfer to full winding can be made at higher speed after current has fallen off.

Questions on the Code

Answered by:

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
R. E. WARD, *Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.*

Wiring in a Dental Office

Q. *What type wiring is required in a dental office where dental surgery is to be performed using cyclopropane as the anesthetic?—H.B.*

A. Although Article 510 does not mention dental offices, it is my opinion that dental office wiring should be installed according to Section 5135 of the National Electrical Code. There is a definite hazard connected with such an operation that is not generally present in a hospital operating room, such hazard being the clothing a dental patient would wear compared with regular operating room clothing made of cotton. Such clothing could be of synthetic material that could create static electricity, especially when in contact with other plastic or synthetic material such as a dental chair is covered with. Provision should be made for draining static electricity from the patient's body and clothing.—R.E.W.

Underground Conduit Installation

Q. *Can you please tell me the values of the insulation covering RW, RHRW, RHW and TW, when either one of these wires are laying in water. All of my wire tables say wet and moist, but how wet is wet? What is the life of any of these insulations when laying in a conduit that is leaking and accepting water maybe through the couplings underground?*

I have a job that has an old 3-wire service underground, and there is water in the conduit. This conduit is 95 ft long and it is covered with concrete all the way, so it can't be dug up or replaced. There is no way of re-routing a new run as this concrete is about 25 ft wide. I know I can't remove the water as it would only fill up again. Will TW lay in water better than RHRW or others? —J.P.W.

A. The provisions of Section 3102b of the code, which concerns conductor insulation, reads as follows:

"WET LOCATIONS. Insulated conductors used underground, in concrete slabs or other masonry in direct contact with earth, in wet locations, or where condensation or accumulation of moisture within the raceway is likely to occur, shall be moisture-resistant, rubber-covered (Type RW); moisture-resistance, thermoplastic covered (Type TW); lead covered; mineral insulated-metal sheathed (Type MI); or of a type approved for the purpose."

The forthcoming 1959 edition of the code undoubtedly will also recognize RHW, and the newly developed THW insulations for the same purpose.

This rule indicates to me that the code anticipates the accumulation of moisture within an underground conduit, and when the above recognized insulations are used, they will perform satisfactorily within the degree of safeguard provided by the code.

Section 7352 requires underground conduits or ducts, when not located below the frost line, to be arranged to drain. Abbott's N. E. Code Handbook explains the occasion for this rule as follows:

"An underground conduit that is not arranged to drain is practically certain to contain water and, if the water freezes, the resulting pressure is very likely to crack the lead sheath on lead covered cable. It is probable that Type RW or TW conductors would not be damaged under this condition. In many cases it would be quite difficult to comply with this requirement."

Here again the code recognizes the fact that underground raceways are likely to contain water, and when the above recognized insulations are used satisfactory service may be expected.

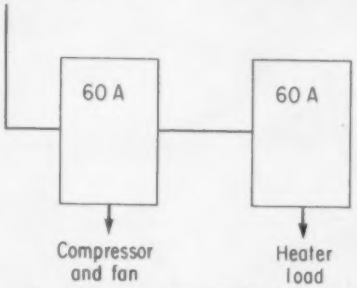
The provisions of Section 5015-c-5 recognize the possible need for draining raceways. This rule covers hazardous locations where the desired degree of safety is much higher than provided for in other locations.

A brief summary of the foregoing rules indicate that the Code anticipates the accumulation of water in underground conduits, and in some instances required drainage for such conduits. If the Code intended that all underground conduits should be arranged for drainage, it appears that a provision to this effect would be inserted in Section 3102-b.

Insofar as the code is concerned, there appears to be no distinction between the various types of insulations recognized for use in wet locations, and in the absence of authoritative information, it is difficult to appraise the life of such conductor insulations when immersed in water which enters the conduit through fittings. The chemical characteristics of the soil or the concrete may have some influence on the life of the conductor, or in the case of conduits in service stations, gasoline could enter the conduits and deteriorate the insulation when it is not protected by a nylon jacket. Since the installation in question is an underground 3-wire service, two lead covered conductors with a bare neutral grounded conductor might solve the problem. In this case extreme care must be taken to see that no breaks in the lead sheath occurs while handling or installing such conductors.—B.A.McD.

Heat Pump

Q. *Will two 60-amp switches meet code requirements for a 5-ton GE heat pump? Fans are ¾ and ½ hp.—W.W.*



A. Your drawing indicates that one of the 60-amp switches feeds the 5-ton compressor, the ¾ hp and the ½ hp fans. Assuming the 5-ton unit will require a 5 hp, 240-volt, 3-phase motor and that the fans are also 240 volts, 3-phase units we may make calculations based on code values for the motor

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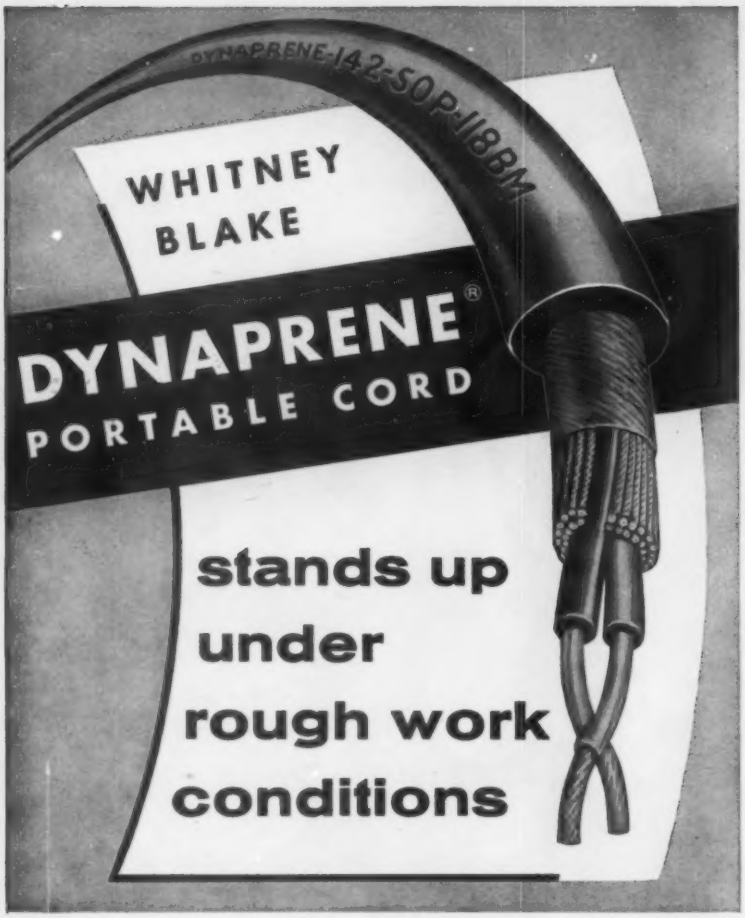

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full load currents. Actually, in most cases, the compressor motor will be of the sealed (hermetic type) and the special rules in Sections 4304b (proposed 430-7c), 4309b (430-6b), proposed 430-32a, -32c1 and -34, 4383e (430-83, exception 3), and 4403b (430-110b), would be applicable.

The full load currents for the 5 hp, ¾ hp and the ½ hp motors would be according to Table 24 (proposed Table 430-150), 15, 2.8 and 2 amps, respectively. The maximum size of branch circuit fuse rating would be 3 × 15 plus 2.8 plus 2 or 49.8 amps. 50-amp fuses would be required and the 60-amp switch would be of sufficient size for this load.—B.Z.S.

Intrinsically Safe Wiring

Q. *I am confused by the National Electrical Code when it comes to the wiring of extremely low voltage devices, like thermocouples, in hazardous locations.*

Are circuits in the millivolt range "intrinsically safe" according to paragraph 5001? *Paragraph* 5034a, *however, mentions compliance with Article* 500 *"irrespective of voltage."*

When it comes to combustible anesthetics, paragraph 5135 *(c and g) seems to set eight volts as a critical value for applying Article* 500. *Paragraph* 7252 *also seems to add confusion to the issue. Specifically, what part of the code applies to the wiring of the circuit between a temperature controller in a non-hazardous area and its thermocouple located in a Class I, Division* 1 *area?—I.S.A.*

A. This question has been the source of considerable discussion during the past few months. For the benefit of our readers, the provisions of Section 5001 reads as follows:

"Equipment and associated wiring approved as intrinsically safe may be installed in any hazardous location for which it is approved, and the provisions of Article 500 and 510 will not apply to such installation. Intrinsically safe equipment and wiring is incapable of releasing sufficient electrical energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture. Abnormal conditions will include accidental damage to any part of the equipment or wiring, insulation or other failure of electrical components, application of over-voltage,

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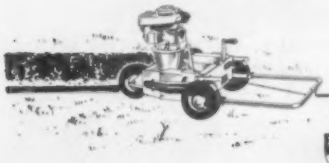

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adjustment and maintenance operations, and other similar conditions."

The occasion for this rule, which first appeared in the 1956 Code is explained as follows:

"Recognition of intrinsic safety in Article 500 has been requested by the Instrument Society of America. There has previously been no basis on which such equipment and wiring could be submitted and approved, and recognition will set up a basis for such approval."

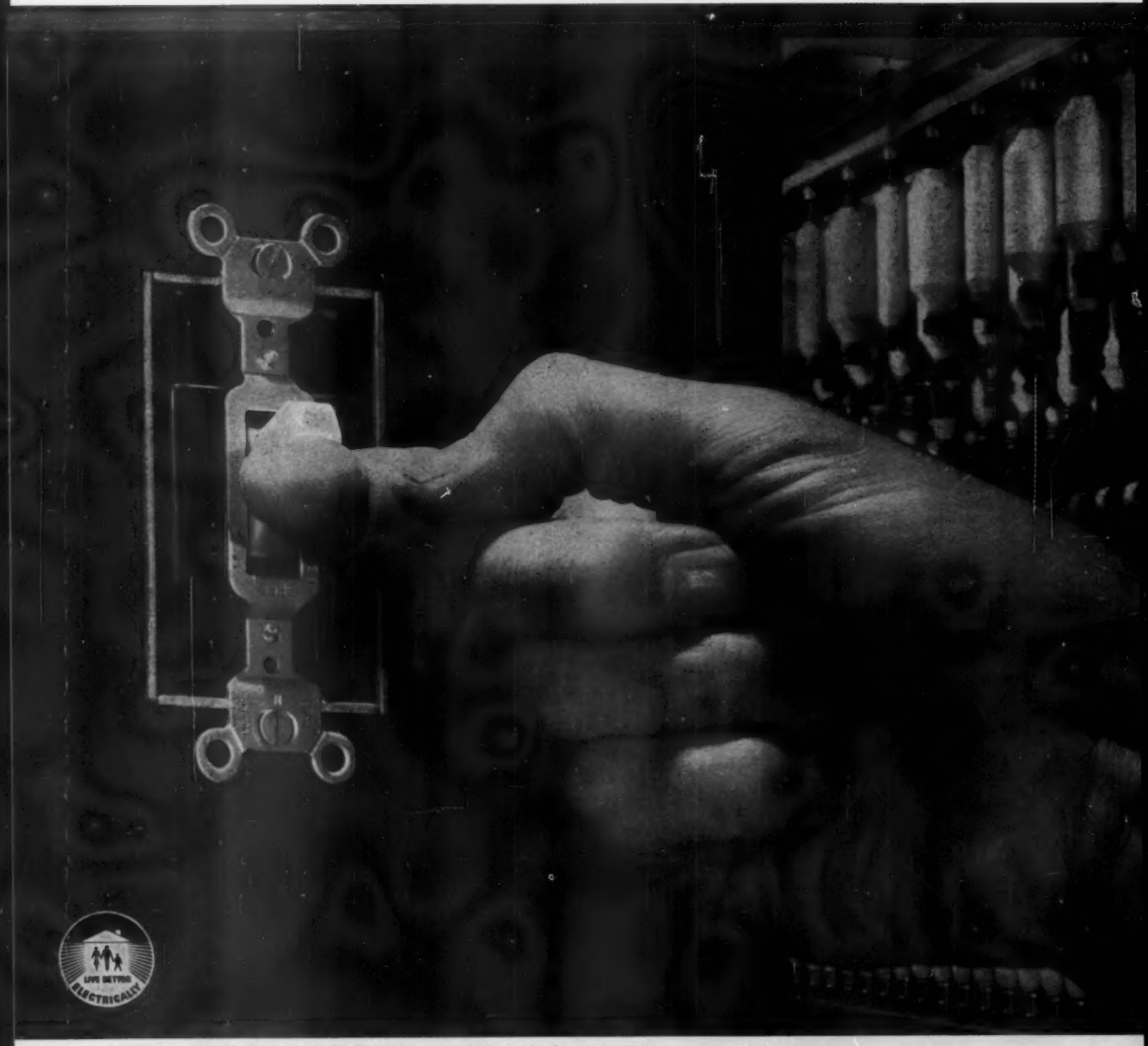
C. M. Park, Chairman of Panel No. 14, N. E. Code Committee, comments on the above as follows:

"It has not been the intent of Code Panel 14 to catalog types of electric circuitry which may be considered intrinsically safe. Section 5001 defines intrinsic safety and states that intrinsically safe equipment may be installed in hazardous locations without special wiring rules. This section stipulates that the apparatus be approved as intrinsically safe.

"Whether or not thermocouple wiring could be recognized as intrinsically safe would depend on a great many factors, and certainly it would not be advisable to assume that all thermocouple installations were intrinsically safe.

"It is quite likely that the majority of thermocouple installations would be intrinsically safe, but there may be other such installations which would not be so classified."

Since the status of a thermocouple, or a thermopile, as a means for generating thermo electric current has not, to my knowledge, been established by the code of Underwriters' Laboratories, one may only speculate, and a hazardous location should never be a matter of speculation. While the NFPA provides authoritative information with respect to ignition temperatures of many common hazardous chemicals and gases, I am unable to find any authoritative information with respect to the temperature of an arc produced from a thermocouple of a given size. How are we to determine the hazard involved with a source of ignition which is measured in terms of milliamperes and millivolts? Are currents derived from thermocouples considered to be intrinsically safe? It is contended that 70 millivolts are required to measure a temperature of 2400 F, while thermopiles of larger ratings are required for the regulation of safety controls. What is the temperature of an arc produced by a 70-millivolt thermocouple? Would it ignite a hazardous atmosphere of



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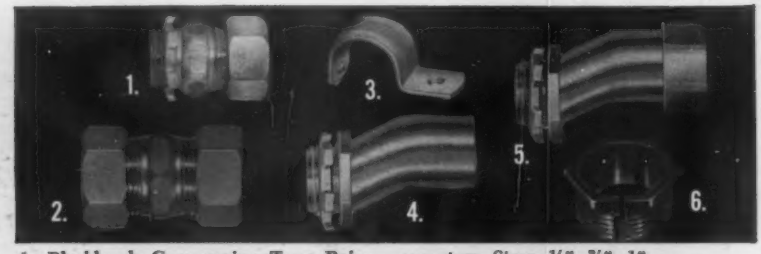

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Ethyl Nitrate whose ignition temperature is 194 F, or would it ignite gasoline vapors with an ignition temperature of 600 to 800 degrees Fahrenheit? These are the questions which I am unable to answer with a background of authority. These are questions which may only be resolved by a qualified laboratory with trained personnel. As Mr. Park intimates, there are many variables involved, and it is significant to note that a thermocouple installation approved as intrinsically safe for one hazardous atmospheric mixture may not be safe for another. This is evidenced by the wording of Section 5001.

Advice from a very reliable source indicates that major engineering and construction firms, specializing in refinery and chemical plant work, and all major oil companies, are standardizing on non-explosion-proof wire for their thermocoupling circuits, and favorable field experience appears to justify such procedure. In the absence of factual information such procedure could be questioned. As previously stated, Section 5001, which concerns intrinsically safe equipment and wiring, was inserted in the code three years ago for the purpose of establishing the basis of approval for such equipment. As a result, we now have a situation where the code specifically recognizes the fact that intrinsically safe equipment may be hazardous unless it is approved for a specific application. This places a severe responsibility on the shoulders of the authority enforcing the code, and in the absence of reports from a qualified laboratory, one should not treat the matter lightly.

The following report which concerns the use of thermocouples used for measuring temperatures was obtained from Frank Camus of Shreveport, La. The experiment was conducted by Mr. Jake Tew. It reads as follows:

"Using a pilot generator consisting of eight thermocouples connected in series and heated well above 1000 F, a voltage exceeding 250 millivolts was produced. By bringing the terminals of the pilot generator slowly together and rubbing slightly just above a rag saturated with cigarette lighter fluid (the most volatile liquid on hand at the time) we believe that we produced a situation far abnormal to any situation that would ordinarily be encountered in the use of thermocouples for temperature measurement. We also checked for a visible spark with the terminals in a dark

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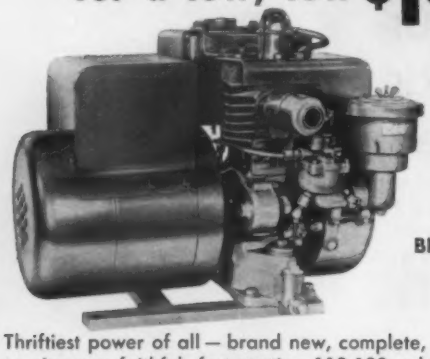

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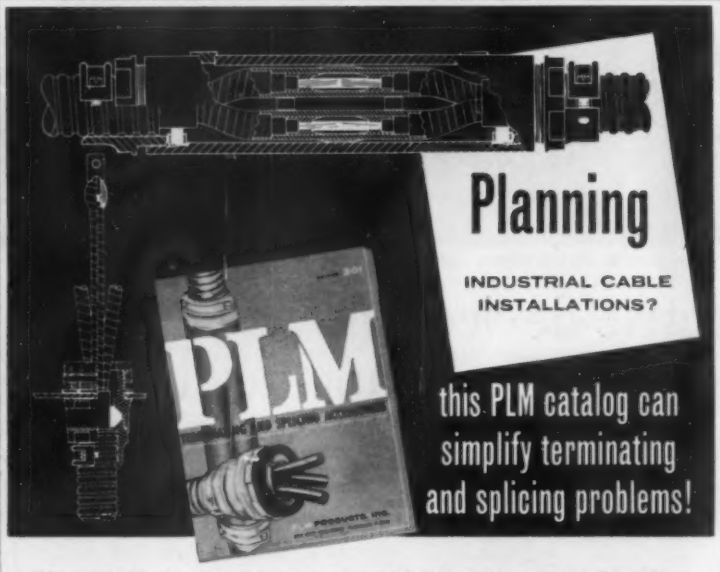

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spot. There was no spark visible.

"From Leeds & Northrup Co. conversion tables we find that on iron vs constantan thermocouple produces 50.05 millivolts at 1600 F with a reference junction of 32 F.

"From the same publication—chromel vs alumel will produce 54.73 millivolts at 2490 F. with a reference junction of 32 F.

"Other types of thermocouples listed in the publication will not stand up under temperatures high enough to produce the same number of millivolts."

In so far as Section 5024-a, which applies to signal, alarm, remote control and communication systems, is concerned, I do not believe that it applies to intrinsically safe wiring. The same reasoning applies to Section 5135 c and d, and also Section 7252. There is, in my opinion, a clear distinction between these sections of the code and Section 5001. In fact, these rules were developed many years before the code recognized wiring classed as intrinsically safe, and I don't believe there was any intent at that time to cover the wiring derived from thermocouples. If so, I believe it would have been specifically mentioned.

In reply to your last question, the thermocouple wiring in the hazardous area must be approved as intrinsically safe as required by Section 5001. If it is not so approved it must comply with the provisions of Article 500. If it is approved as intrinsically safe there appears to be no specific code provisions. If such a system is installed in a raceway, the provisions of Section 5015 concerning sealing should be satisfied. This is a question which should be more clearly covered by the code in the future.

While it may be contended that conventional conduit and fittings are suitable for enclosing thermocouple wiring in a hazardous location, I am inclined to believe that the many variables involved coupled with the absence of authoritative advice prompts one to apply a liberal factor of safety. I do not believe we should walk the thin line that separates the safe from the hazardous. The responsibility for a safe electrical installation in a hazardous location is one that should not be discounted, and economic considerations should not influence a decision. Until the code and UL spells out, in more detail, the status of "intrinsically safe equipment and wiring" I am inclined to believe that the provisions of Article 500 should be satisfied.—B.A.McD.

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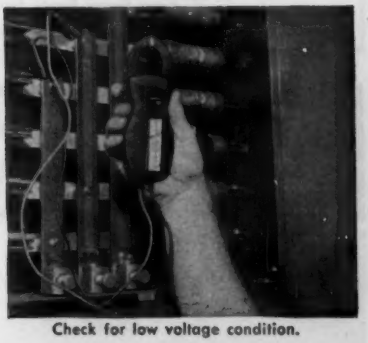

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Exit Lights

Q. *In a large school gymnasium or auditorium is it permissible to wire the exit lights from a sub-panel located in the gymnasium or auditorium with main switch located in basement of building well away from gymnasium and auditorium?—R.E.D.*

A. No.
Section 7015. "SUB-SERVICE TAPPED AHEAD OF SERVICE DISCONNECTING MEANS. Connections on the line side of the main service if sufficiently separated from main service to prevent simultaneous interruption of supply through an occurrence within the building or group of buildings served."

Section 7021. "EMERGENCY ILLUMINATION. Emergency illumination shall include all required exit lights and all other lights specified as necessary to provide sufficient illumination to enable persons to see their way out of the building."

From Code Section 7021 one will see that all required exit lights are classed as emergency illumination. Section 7015 requires connections on the line side of main service for emergency illumination. It will be noted from Sections 7012, 7013 and 7014 that other methods of emergency illumination can be provided. —R.E.W.

Four-Wire Panelboards

Q. *Would the code require the use of 4-wire panels on 120/208-volt, 4-wire?—C.T.*

A. No. Two, three or four wire panelboards may be used as required for the particular loading on any one feeder in this 4-wire system.—B.Z.S.

Direct Burial Bare Conductor

Q. *A 120/208-volt direct burial underground service consists of four single conductors. May the neutral conductor be bare? —F.C.*

A. Section 3102b does not deal specifically with service conductors, but rather with conductors used for general wiring.

It should be noted that this sec-

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- The absence of moving parts in Berko glass units guaranteed a minimum of call backs. I can't recall a single instance of mechanical failure.
- Berko glass radiant heating panels are beautifully and distinctively designed. The lady of the house liked them whereas some we had handled previously were too heavy and mechanical looking. In addition, when we handled other heaters low-price competition was often able to beat us out with units very similar in appearance. There's nothing that compares to Berko in design and we have no worries on that score.
- Last but not least, Berko saved us a fortune in installation costs. It was no longer necessary to cut into walls or draw so many special lines. Berko units mounted right on the wall. Knockouts conveniently located permit direct cable entrance and keep our service requirement to a minimum.

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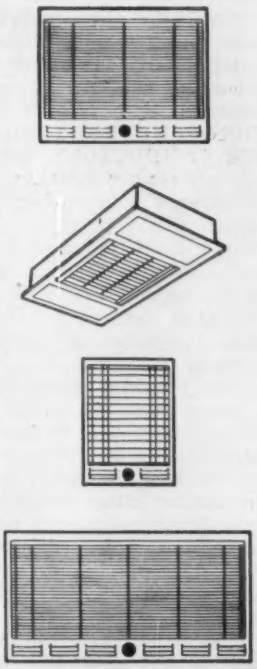

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ond paragraph in 3102b states that direct burial cables shall be of a type specifically approved for the purpose. A review of the UL listings does not seem to list cables as specifically for "direct burial" except in one instance. Under the classification "Underground Feeder and Branch Circuit Cable" in the general notes heading the listing it does state:

"This Cable (referring to Type UF) may be used underground, including direct burial in earth. . . ."

Furthermore under the classification of "Service Entrance Cable" in the notes for Type USE, it states:

"In addition, cable in sizes No. 4 AWG and smaller and having all conductors insulated is suitable for all of the underground uses for which Type UF cable is permitted by the National Electrical Code."

By inference this would include direct burial of such service entrance cable.

The question of using direct burial bare neutrals may be considered as being prohibited in my opinion, since basically the rules in both Article 230 and Article 310 only give tacit approval for the use of insulated direct burial cable. Furthermore, the bare neutral as a general wiring method is only approved in services, with certain exceptions which do not apply here.

The 1959 Code as proposed does make some recommendations to definitely clarify the use of the bare grounded neutral conductor. In proposed section 230-30, INSULATION—UNDERGROUND SERVICE CONDUCTORS, the general rule will require these conductors to be covered with rubber, cambric, thermoplastic, paper or other approved insulation material. However, one of two specific exceptions in this section deals with the bare grounded neutral conductor for these underground service conductors.

This proposed exception states:

"Bare grounded neutral conductors of copper may be installed underground in duct or conduit."

Two very significant points are emphasized in this exception. First, only copper conductors may be installed as bare underground neutral conductors. Aluminum conductors are not suitable for such installations.

The second point is that when bare grounded neutral conductors are installed they cannot be buried directly in the ground. The conductors must be in a duct or conduit.—B.Z.S.

Outdoor Wiring

Q. *In reference to the diagram below, may No. 8 conductors be used on the pole line shown?—F.N.*

A. Section 7314 (proposed 730-6, 1959 Code) requires No. 8 as the minimum size for long spans of overhead conductors.

The use of a 200-amp switch seemingly at first glance, would be too large, considering possible fuse sizes to properly protect this feeder. The maximum current carrying capacity of the No. 8 wire, considering it to be weatherproof would be 70 amps.

Assume that this feeder has two 10 hp, 240-volt, 27-amp, 3-phase standard squirrel cage motors on it, one in each building. The maximum size feeder fusing, assuming nonsimultaneously starting of the motor would be

3×27 plus 27 or 108 amps.

We would use 125-amp fuses in a 200-amp switch.

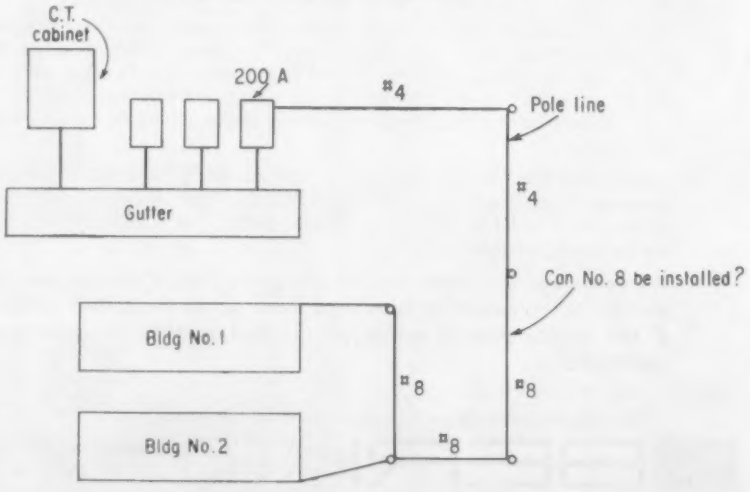
The feeder would have to have a minimum current carrying capacity of

1.25×27 plus 27 or 60.75 amps.

The installation as shown would be permissible from the standpoint of code requirements. The question of voltage drop, starting currents and possible light flickering would have to be checked. The wider separation of the conductors in pole line construction (unless aerial cables are installed) aggravates the problem of voltage drop since this drop increases as the separation between conductors is increased.

Also, as a practical problem it may be found that the No. 8 wire, while permitted by the code, may not be feasible. It should be noted that the same section quoted above, viz 7314 (730-6) requires that No. 6 be the smallest individual conductor permitted for overhead spans, and that No. 8 be permitted only when used in cabled overhead spans, whenever the voltage exceeds 600 volts.

Actually there is a move on foot, especially where high voltage circuits are involved, to require a minimum of No. 2 conductors. This minimum size would be required whether individual conductors would be extended or whether the conductors were part of a cable.—B.Z.S.



Installing Signals in Anesthetizing Location

Q. *Article 510, Section 5135 (f) states in part:*

"A green signal lamp conspicuously visible to personnel in the anesthetizing location shall remain lighted while the system is isolated from ground, but an adjacent red signal lamp and an audible alarm signal shall be energized when the indicator responds to leakage current. The indicator and associated signals shall not be installed within a hazardous area."

How may such device be installed where visible to personnel in the anesthetizing location and still not be installed in the hazardous area?—F.O.

A. Section 5135 (b)-2 states: "In an anesthetizing location as defined in paragraph a., the entire area shall be considered to be a Class I, Division 1 location which shall extend upward to a level 5 ft above the floor."

Install such device above the 5-ft level.—R.E.W.

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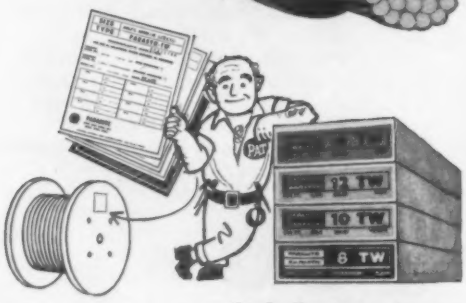

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John Watt Joins Editorial Staff

John H. Watt joined the editorial staff of *Electrical Construction and Maintenance* on July 13, as Associate Editor. He is located at the headquarters office in New York.

He was formerly Assistant State Superintendent of the Electrical Department of the New York Board of Fire Underwriters. Prior to that time he was Associate Electrical Engineer of the Seattle, Wash. Department of Buildings and manager of the Green Lake Electric Co., electrical contractors, of Seattle.

Mr. Watt is a graduate of Edison Technical School of Seattle and served in that school as a teacher of electrical theory, mathematics and industrial electricity. He has served on numerous industry and Code committees in the Northwest.

New York State Electrical Contractors Hold Annual Meeting

"Developing the Climate for Electrical Growth by Using Our Industry's Promotional Programs" was the theme of the 60th annual convention of the New York State Association of Electrical Contractors and Dealers held at Whiteface Inn, Lake Placid, N. Y., July 7 to 10. Approximately 370 members and guests of all branches of the electrical industry attended.

R. J. Knoblock of Syracuse was chairman of the opening session. Herman L. Weisman, counsel to the New York Electrical Contractors Assn., spoke on "The Cause and Cure of Vanishing Profits in the Climate of Prosperity in the Electrical Industry." He pointed out the economic facts of business to the electrical contractor. The causes of vanishing profits, job chiselling, unsound and unethical bidding practices were exposed as being harmful to the entire industry as well as to the practitioner. The cure, Mr. Weisman stated, lies in honest development of labor and material figures, the addition of fair overhead and profit margins, and the presentation of a bid to the buyer which will deliver a complete and adequate installation without resorting to subterfuges or "extras" to pull the job out of the "red." Changes or additions when they occur should be fairly priced. Profits can be earned and contractors can be better businessmen if they will serve their customers well and honestly without resorting to the malpractices which ultimately benefit no one, he concluded.

C. E. Schaad, state superintendent, Bureau of Electricity, New York Board of Fire Underwriters, stated that in New York City alone 767 apartment buildings were adequately rewired in 1958 under Consolidated Edison's rewiring program, a gain of 50% over 1957. The Board's reinspection program resulted in 10,745 inspections, an average of 895 per month. The five-month figures of 1959 show a monthly increase of 5% in the number of reinspections over 1958.

Paul M. Geary, executive vice president, National Electrical Contractors Assn., Washington, D. C., stated that according to information available, there were 12,675 electrical contractors in the U. S. in 1958 employing IBEW electricians. Their aggregate productive labor payrolls were over $913 million. Of these contractors, 80% employed an average of less than ten men each; and 20%, about 2500, employed an average of more than ten men, but accounted for about 70% of the total payroll.

Mr. Geary said that statisticians, compiling national figures, estimate there is about $15 billion of electrical contracting business done annually in the U. S. He advised the contractors to develop their share of this volume at a fair profit to themselves and with sound workmanship for the buying public.

R. B. Denhardt, manager of New Business Development, Central Hudson Gas and Electric Corp. of Poughkeepsie, spoke on the commercial and residential market, using slides and a film prepared by the Westinghouse Electric Corp. to expand his subject. Planned projects for new shopping centers, office

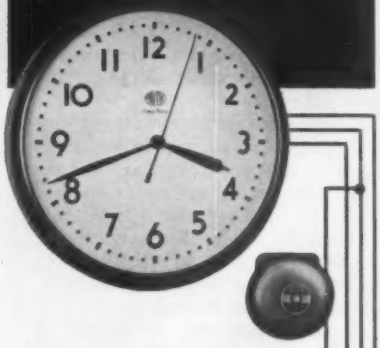
SLATED TO GUIDE up-coming activities for The Electrical Maintenance Engineers Association of California is the above-pictured Executive Committee consisting of (seated, L to R): Urban Beh, Consulting Lighting Engineer; Paul H. Hendrichs, S. Calif. Edison Co., 1st vice president; Charles M. Tabor, Larson-Hogue Electric Co., president; Frank R. Tharp, Electric Machinery Maintenance Co., second vice president; Lloyd A. Gates, L. A. Dept. of Water & Power; and (standing) William Paluska, A. C. Martin and Assoc.; O. D. "Oz" Land, Bay Cities Floodlight and Electric Co.; William E. Cline, General Electric Co., sec.-treas., and Ernest Burgess, Harvey Aluminum Div., Harvey Machine Co.

Simplify

SPECIFICATION...
INSTALLATION...
MAINTENANCE...

with **Auth**

CLOCK and Program SYSTEMS



AUTH Clock Systems feature Telechron-motored, self-starting synchronous movements. They operate directly on ever-accurate alternating current supplied by the central power station, without the use of master clocks, relays, rectifiers or other auxiliary devices.

When current fails all clocks are collectively restored to correct time either manually or automatically. By adding a program instrument and audible signals AUTH Clock Systems provide a simple and flexible method of programming activities of large groups in schools, industrial plants, etc. Simplicity is the keynote . . . with AUTH Clock Systems.

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SINCE 1892

AUTH ELECTRIC COMPANY, INC.
34-20 Forty-Fifth Street
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Please send booklet on AUTH Centrally Controlled Clock and Program Systems.

Name_____ Title_____

Company_____

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and public buildings, and outstanding modernization projects were shown. He spoke of the $500 billion construction and $250 billion maintenance and modernization market projected for the next ten years. The electrical share of this vast potential he placed at a total of $108 billion.

J. S. Voorhees, manager of the Wholesale Business Bureau of the Consolidated Edison Co., New York, pointed out the tremendous market in the Borough of Manhattan alone, presented by a continuing demand for a diversified quality of office space. In Manhattan 6,272 buildings are classified as loft buildings containing approximately 180 million square feet of net rentable area and this market has scarcely been touched. The potential market for rewiring of risers alone is about $25 million, a fraction of the total expenditure by building owners, to be followed by even more substantial expenditures for tenant alterations.

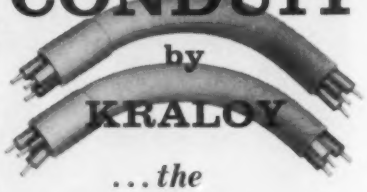
"Long Island Grows Up" was discussed by E. C. Duffy, senior vice president, Long Island Lighting Co., Mineola. He stated that the population on Long Island has increased by 367,328 and electrical energy requirements increased, as a result, by 55% in the last four years. He referred to the many promotional programs made available by all the various electric industry groups.

Edwin Vennard, vice president and managing director of Edison Electric Institute, presented the role of electricity in American progress and contrasted the role of American workmen in our economy with that of Russia's counterparts, based on observations made by him during a recent trip to Russia.

F. H. Roby, executive vice president of Federal Pacific Electric Co., Newark, spelled out seven ways to sell. P. H. Farley, manager of Distributor and Contractor Sales, Anaconda Wire & Cable Co., New York, presented the case for the salesman. C. S. Menger, executive vice president, Triangle Conduit & Cable Co., New Brunswick, N. J., discussed how expensive guessing can make for a profitless electrical industry.

R. H. Jones, general manager of General Electric Supply Co., Bridgeport, Conn., stressed the need for teamwork as the key to industry growth and profits. In his opinion, the one area which offers the greatest profit potential for electrical contractors is creative selling. One market, he said, which seems to

NEW
PLASTIC PVC
CONDUIT
by
KRALOY



. . . the revolutionary new electrical conduit with these distinct advantages:

- WILL NOT SUPPORT COMBUSTION
- RUST AND CORROSION-FREE
- SIMPLIFIED INSTALLATION
- GREATER ECONOMY
- MOISTURE PROOF • LONGER LIFE

Kraloy PVC (rigid, unplasticized polyvinyl chloride) Conduit is in demand as a strong, economical, light-weight, permanent conduit for all power and communication wire installations within its size limitations. Inside diameters have been engineered to Underwriters' conduit specifications.

Today, engineers specify Kraloy PVC Conduit and fittings for their electrical installations for good reason. Kraloy is easy to install, has safer, longer lived physical properties, reduces cost of installation and materials by *more than half*, and is steadily earning the approval of municipal authorities.

Because of its semi-rigid construction, Kraloy PVC Conduit is easily worked into contours. Its high-impact rating guards against earth movements and shocks of all kinds.

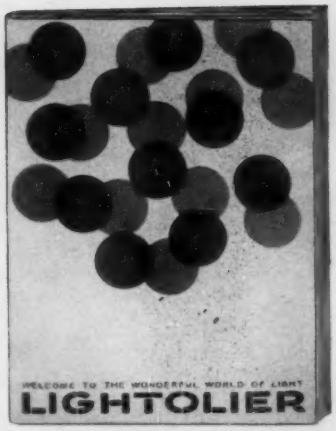
In exhaustive tests Kraloy PVC Conduit has proved to be a far superior, safer and more economical conduit.

For complete information on Kraloy PVC Conduit and Fittings for all wiring specifications, write Dept. ECM-8

Some territories still open for qualified representatives.

K-59-20

PAYOFF: PROFITS! WHEN LIGHTOLIER'S NEW STYLE BOOK WORKS FOR YOU



Hot off the press, the new Lightolier Style Book—96 pages big—colorful, easy to use. It sells a spectacular array of lighting — residential fixtures, functional lamps, recessed and fluorescent units. There are scores of new, exciting budget goods that are ideal for your every day needs...over 100 new higher ticketed fixtures, too. Ask your Lightolier distributor for your copy. It's a hard-selling showroom in print that will produce profits everywhere you use it. Or, mail coupon today.

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Please send me my copy of the new Lightolier Style Book.

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EC-89

Shuford's

SHURTAPE® EP-40

Use Shuford's SHURTAPE EP-40 for coil or harness wrap and many other electrical applications requiring a high tensile paper tape with good dielectric strength.

The rubber impregnated, rope paper backing has high electrolytic corrosion resistance. It is solvent resistant and features a low moisture vapor transfer rate. The thinness of the tape reduces the overall bulk of the wrap.

Use Shuford's SHURTAPE EP-40 pressure-sensitive paper electrical tape in small quantities or for high volume production . . . you'll find it efficient as well as economical!

Write for free sample roll and complete information to

Shuford Mills, INC. SINCE 1880
HICKORY, N. C.

CLOTHES LINES • TWINES
PRESSURE-SENSITIVE PAPER TAPES
SASH CORDS • WEATHER STRIPPING
COTTON & RAYON YARNS • EXTRUDED PLASTICS

World's Largest Manufacturer of Cotton Cordage

3982

MONTREAL CONVENTION of the National Industrial Service Association drew a large U. S. and Canadian representation, including: (l to r) R. J. Bishop, Electric Service Repair, Paterson, N. J., and Jerry Gross, Dick's Electric Service, Liberty, N. Y.

hold tremendous promise for creative selling is relighting. The average lighting in industry today is 35 footcandles and according to industry experts, it should be three times that level.

On Utilities Day Howard B. Wakeman, senior vice president, Long Island Lighting Co. was chairman; and Manufacturers and Wholesalers Day was chairmanned by C. A. Biddulph, vice president, The Thomas & Betts Co., Elizabeth, N. J.

At the business session on Friday morning, Herman L. Weisman of Amen, Weisman and Butler, New York City, was appointed counsel for the Association. The following officers were re-elected—A. L. Bush, chairman emeritus, H. F. Janick, president; H. A. Webster, 1st vice president, J. M. Smith, 2nd vice president and secretary, and R. J. Knoblock, treasurer. J. P. O'Brien was elected financial secretary. In addition to the present members of the board of directors, the following were elected to serve this year: Hyman Bader, Felix R. Shelley, J. E. O'Connor, R. A. Goeller, Jr., Thomas Meeker and Marvin Anderson.

New Static AC Switch

A new static switching device for alternating current, the Ovitron, employs a radically new principle of operation called "electro-ionic surface impedance control." Two tantalum oxide coated electrodes are immersed in an acid electrolyte

BELLS

for all types of installations

Single stroke or vibrating

in all voltages—DC 6 to 220 v. AC 6 to 250 v. in sizes from 3" to 12"

For all telephone or alarm systems. Housings of sturdy cast aluminum with excellent clarity and high decibel output. Underwriters Laboratories listed. Also a full line of cow bells and buzzers.

Write for literature

HOSE-McCANN TELEPHONE CO., INC.

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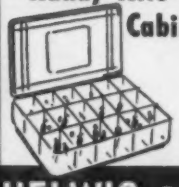
Control Your CARBON BRUSH Inventory with Handy-Kits and Cabinets



HELWIG CARBON BRUSHES

Units have lifetime guaranteed See-Thru plastic drawers with moveable dividers. Both Handy-Kit and Cabinets complete with brushes for single phase motors, vacuum cleaners, mixers, fans, portable tools, etc. Units assure you have the right replacement stock on hand.

Write for Bulletin No. 65.

AVAILABLE NOW "RED CARPET" RUSH BRUSH SERVICE.

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CARBON PRODUCTS

2546 N. 30th ST.
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HELWIG SPEER

go modern with a Sylvania Surface Mounted Fixture

Sylvania offers *two* attractive series of shallow, surface mounted fixtures . . . the *Mohawk* and the *Seneca*.

From these two fixture families you can choose appropriate lighting units for modern low ceilings . . . and to match the proportions of almost any room. You have an extensive selection of widths, of shielding media and of lamp types to practically custom-design every lighting installation.

Take a look at some of the outstanding features of these two fixture families. Then keep Sylvania in mind the next time you have an installation that calls for surface mounted units.

These two fixture series typify the broadness of Sylvania's entire line of modern fluorescent lighting equipment. To bring yourself up to date on the most complete fluorescent fixture line in the industry, write today for a catalog of Sylvania's Lighting Fixtures and Systems.

SYLVANIA LIGHTING PRODUCTS
A Division of SYLVANIA ELECTRIC PRODUCTS INC.
Department 59-5
One 48th Street, Wheeling, West Virginia

Sylvania's MOHAWK Series

This series of shallow fixtures comes in two widths. The *Chief* is a nominal 1′ wide and uses two lamps. The *Super Chief* is available with either four or six lamps in a nominal 2′ width.

All units of the MOHAWK Series feature sturdy "wrap-around" chassis with ribbed plastic side panels. These polystyrene side panels illuminate the surrounding ceiling area to minimize brightness contrasts with ideal blending of fixture and ceiling.

Through the use of a smooth fitting, hidden-hinged shield frame, the MOHAWK provides a wide selection of shieldings in plastic, metal and glass, to fit individual shielding preferences.

Sylvania's SENECA Series

The SENECA features a dished panel of acrylic plastic which fastens directly to the fixture body without extra supporting devices. The resulting clean lines present a smart appearance which harmonizes with modern interiors. Together with soft, diffused illumination, the fashionable appearance of the SENECA makes it the ideal fixture for many stores and offices, both large and small.

The availability of three different widths in this versatile, solid-sided fixture series—13⅜″ with two lamps; 15⅛″ with four lamps; 23¾″ with six lamps—makes it simple to select the fixture width for the desired illumination level and room appearance.

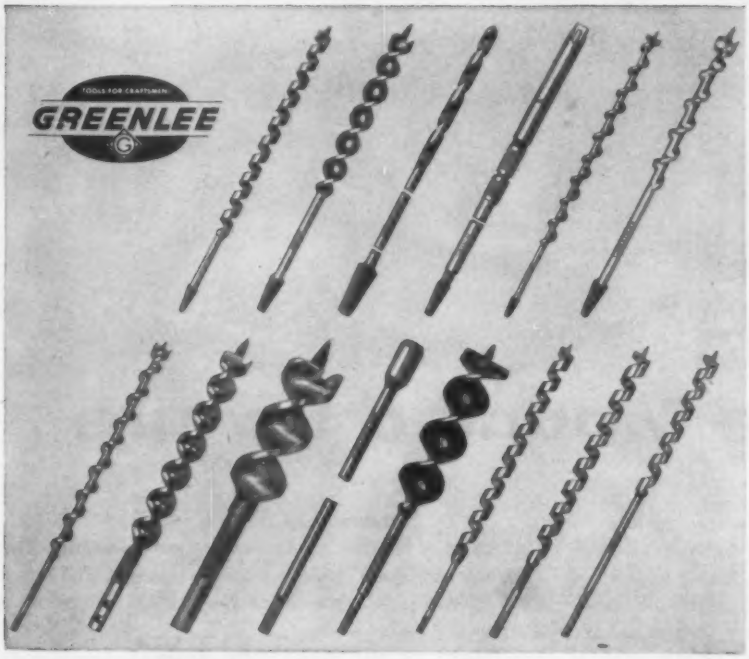
GO MODERN WITH LIGHTING BY **SYLVANIA**

Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

FLUORESCENT LIGHTING FIXTURES AND SYSTEMS • BEST FIXTURE VALUE IN EVERY PRICE RANGE

Fast-Cutting

Precision-Made Greenlee Tools for Electrical Installation Work



high-quality bits and extensions for every power drill or brace job

Installations go smoother, faster when you standardize on precision-made GREENLEE tools. Power drill and hand brace types . . . various styles and lengths for all types of electrical work. All of highest quality materials, carefully heat-treated and made with correct design for fast, accurate boring and long life under hard usage.

The GREENLEE line includes Electricians' Auger Bits and Power Bits, Solid-Center Auger Bits, Bell Hangers' Drills, Expansive Bits, Pipe Bits, Ship Augers, and Extensions.

GREENLEE Power Bits for ½" and larger chucks feature new hexagon shank for positive drive. Eliminates slippage on tough power boring jobs. See your distributor for these timesaving tools or write for descriptive bulletins.

new *ZIP BIT*
wood boring power bit and extension

Greenlee No. 33 spade-type electric drill bit with exclusive nonslip *hexshank*. Bores in any wood, at any angle, any speed.

- Hex shank gives positive, *nonslip* drive . . . added strength.
- Chucks quickly, accurately in any ¼" or larger electric drill.
- Cutting edges easily resharpened.
- 13 sizes ¼"-1"

No. 901 Bit Extension for Greenlee ZIP BIT. Hex shank fits ¼" electric drills. 12" length. Holds all bits with ¼" shank.

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK: CONDUIT BENDERS, PIPE PUSHERS, KNOCKOUT PUNCHES AND DRIVERS, CABLE PULLERS

GREENLEE TOOL CO. GREENLEE

1760 Columbia Ave., Rockford, Illinois

with a third "grid" electrode. The normally non-conducting electrode surfaces are instantly changed to a conducting state by a small pulsating direct current in the "grid" circuit, allowing ac to flow between the load controlling electrodes. When the control current is removed the electrode surfaces immediately return to their non-conducting state, interrupting the ac current in the load circuit.

The device is said to be not affected by temperature changes within its rating nor by the number or frequency of operations. It is contained in a permanently sealed capsule.

In closed position, the resistance of the switch is approximately 2 ohms. Working models, in approximately 2 in. by 2 in. cylinders, handle about 4 amps at up to 70 volts ac. Control current is derived from the switch cell without other external supply.

Electrical Enabling Act in Iowa

On April 28, 1959, the State of Iowa passed an enabling act, permitting a town or city to license electricians and electrical contractors.

While many cities in Iowa have had licensing ordinances for as long as 40 years, a Supreme Court decision invalidated these ordinances several years ago, and prompted the recently approved enabling act.

The legislation was introduced by the Iowa State Electrical Industry Council, which was organized for this purpose. Other co-sponsors who assisted ISEIC in gaining approval of the enabling act were the Iowa chapter of IAEI and the Iowa League of Municipalities.

One of the main features of the new law is that while a license is valid only in the municipality in which it was issued, a contractor may obtain a license in another city or town without further examination, provided the standards of licensing are the same in both areas.

The ISEIC is presently distributing a booklet to all its members, showing the general procedure for setting up uniform inspection, licensing, and qualifications for electrical inspectors.

Further information concerning the new license act may be obtained from D. D. Clark, 1118 Mulberry St., Des Moines, Iowa, or M. K. Dewey, City of Cedar Falls, 118 Washington St., Cedar Falls, Iowa.

Minnesota Creates "Installer" License

A new section has been added to Minnesota's State Electrical Law by vote of the 1959 Minnesota legislature. The addition creates a temporary "Class C Installer" license to alleviate a reported lack of electricians to hook up major appliances in the rural areas.

Licensees under the new classification "may undertake to layout, install and repair electrical wiring and apparatus for major electrical home appliances on the load side of the main service entrance equipment in homes . . ."

To obtain a "Class C Installer" license, an applicant must certify by affidavit, subject to verification by the State Board of Electricity, that he has had at least one year's experience in installing or repairing electrical wiring, or prove he has completed a post high school course in electricity and pay an examination fee of $10.

Applicants successfully passing the examination must pay a $5 fee for a one-year license and a $5 fee for renewal. Licensees must post a $1000 bond.

"Class C Installers" will be limited to performing work in farm homes and villages which have a population of less than 1,500 and are not contiguous to a city of the first class and which do not have a Class A or Class B master electrician established in business.

The terms and provisions of the new section will end July 1, 1961.

Leasure Again Heads Chicago Contractors

E. E. Leasure, Jr., president, Monroe Electric Co., Chicago, was unanimously re-elected to his eleventh consecutive term as president of The Electrical Contractors Association of City of Chicago (Chicago Chapter, NECA). Mr. Leasure also is a vice president of the National Electrical Contractors Association.

W. J. Howe, Jr., Livingston & Company, Chicago, was re-elected vice president of the group, and W. J. O'Brien, W. J. O'Brien Electric Co., Chicago, was appointed the Association's representative on the NECA Board of Governors. Jack W. Collins was reappointed to his tenth term as Chapter manager and secretary-treasurer of the 56-year-old Association.

Pull Cable Fast

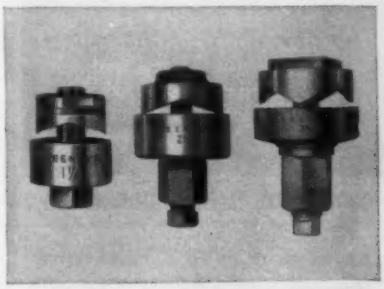
through open or concealed conduit with Greenlee Electricians' Cable Puller . . .

Cable can be pulled at any angle, from any convenient location with a GREENLEE No. 765 Cable Puller as shown here. Puller may be hand-operated, as shown at left, or power-operated, with any portable electric drive as shown above. Drum swivels to give complete operating clearance.

Here's the way to simplify large-size cable pulling. With a GREENLEE No. 765 Electricians' Cable Puller on the job you get it done far faster . . . easier . . . and at far less cost. This powerful puller exerts a maximum pull of 7,500 pounds and has two operating speeds . . . one for fast work, the other for a steadier, heavy pull. At all times the pull is in line with the conduit . . . no strain on the hangers. Portable, easy to set up and operate. Use it for exposed or concealed conduit . . . high up, in close quarters, or out in the open. See your electrical distributor for details on this timesaving GREENLEE equipment or write for descriptive literature.

Cut conduit holes quickly, easily with Greenlee Knockout Punches

Complete range of knockout punches to make openings for all standard conduit sizes ½" - 5". Fast, easy cutting through 10-gauge metal. Every cut is quick and clean — slug falls free in die. Hand, ratchet, or hydraulic driver operated. Wide choice of sets.



OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK . . . CONDUIT BENDERS, KNOCKOUT PUNCHES, KNOCKOUT PUNCH DRIVERS, PIPE PUSHERS, BORING TOOLS

GREENLEE TOOL CO. GREENLEE

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QUAD REFLECTORS

QUALITY INCANDESCENT REFLECTORS FOR 37 YEARS

INDUSTRIAL LIGHTING

Quadrangle offers America's most complete line of RLM reflectors as well as many other type reflectors. There is a wide range of sizes and a large variety of socket fittings. Many utilize the Quad exclusive Easy-Tach disconnect socket.

FLOOD-LIGHTING

Quad floodlights incorporate design and manufacturing features that are the result of years of research and engineering. There are five different types and more than one hundred and twenty different unit designs to choose from.

SIGN-LIGHTING

There are more than 15 Quad sign reflectors, in a multitude of shapes and sizes, to accommodate lamps from 60 to 1500 watts. There is a size and design for illuminating the smallest signs to the largest outdoor display bulletins.

All Quad Reflectors are rustproof, weatherproof, finished lustrous porcelain enamel. Available with Easy-Tach or Quick-Detachable horizontal, vertical, feed-through or box-type easy-to-wire sockets.

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Dept. 64, 32 S. Peoria St., Chicago 7, Ill.

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☐ Industrial Lighting ☐ Flood-Lighting
☐ Sign-Lighting

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Serving on the Executive Committee are: E. E. Leasure, Jr., Monroe Electric Co., chairman; O. F. Burnett, Jr., Kelso-Burnett Electric Co.; L. W. Johnson, Johnson Electric Co.; W. W. Giesen, W. W. Giesen Electric Co.; C. P. Walters, Jr., Fries-Walters Co.; W. J. Howe, J. Livingston & Co.; T .L. Hankins, Condo Electric Co.; Fred Stocek, Hoffman Electric Co.; E. R. Hansen, Meade Electric Co., Inc.; C. A. Gall, Henry Newgard & Co.; and W. J. O'Brien, W. J. O'Brien Electric Co., Inc.

NISA News

The second annual meeting of NISA's chapter presidents will be held in St. Louis September 25 and 26 at the Clayton Inn in the St. Louis suburb of Clayton, Mo. Delegates from the association's 39 chapters will convene in the evening of September 25 to plan their agenda, then meet all day Saturday, September 26. Last year's meeting was also held in St. Louis.

• • • •

The NISA board of directors will also hold its mid-year meeting in St. Louis on November 13-14 at Clayton Inn.

• • • •

Quaker City Chapter's annual golf tournament and dinner was held at Sandy Run Country Club on June 12.

• • • •

New members of Southeastern Chapter include: F. E. Cahoon, Virginia-Carolina Electrical Works, Norfolk, Va.; O. R. Patrick, Smith-Gray Electric Co., Columbus, Ga.; and Warren E. Dickson, Leesburg Armature Works, Leesburg, Fla. A fall meeting will be held on October 29-31 at Sir Walter Raleigh Hotel, Raleigh, N. C., and a technical forum on April 10-11 in Jacksonville, Fla.

• • • •

The planning committee for Southwestern Chapter's fall meeting, to be held in Houston at the Shamrock-Hilton Hotel on September 17-19, met last month in that city. Attending were Dick Bradley, George T. Kinard, James A. Phares, J. M. Morgan, Miss Ann Hickman, Emil J. Shumberg, George Foshee, Frank Foshee, A. L. Miller, Carl D. Schleyer, Harry Gumbert, A. C. Dudley, H. P. Woolley, J. B. Camp, Fred Fahrenkamp, Herbert Stark, and Edward Clendenin.

• • • •

Robert L. Sandman, of Sandman Electric Co., Boston, was elected

for the LONG PULL use Y-ER EAS Wire Pulling Lubricant

Only Y-ER EAS has all these features

- Creamy, non-corrosive lubricant. Never greasy or messy.
- Prevents sticking or setting. Specially helpful on saddles and turns.
- Does not run back on cables.
- Never harmful to hands or clothing.
- Permanently non-harmful to cables or conduit.

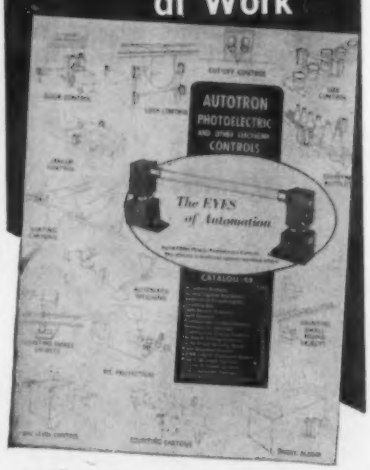
Write for descriptive booklet

GIVES THE SLIP TO— Lead, Rubber, Braid or Synthetic Covered Cables

AT ALL LEADING ELECTRICAL SUPPLY HOUSES

ELECTRO COMPOUND CO.
4149 W. 150th Street • Cleveland 35, Ohio

EYES of Automation at Work



New AUTOTRON Catalogs show wide selection of modern industrial photoelectric equipment including the latest in tubeless controls. Also application diagrams of automatic conveyor control, inspection, carton sorting, smoke detection, die protection, counting, weighing, limit and tension control, conveyor jam-up control, spraying and processing control, ramp traffic control, etc.

Send for your copy today.

AUTOTRON, INC.
Box 722 DDN Danville, Ill.
Representatives in principal cities

president of New England Chapter recently. Other officers are: vice-president, Robert G. Bedig; secretary, Robert M. O'Day; treasurer, Brent L. Smith; directors, Francis P. Sweeney, Hector Munro, Bruce Byrnes, Milton Werby.

• • • •

A meeting of North Central Chapter was held on June 27 at the Sheridan Hotel in Minneapolis. The chapter voted to give a memorial to St. Paul's Lutheran Church, Fairmont, Minn. in memory of the late Frank W. Ross, former NISA director and treasurer, who died suddenly last April 18.

• • • •

Perry Wood was re-elected president of Northern California Chapter at a recent meeting at Gino's Restaurant, San Francisco. Also re-elected were: vice-president A. E. Dutil, and secretary-treasurer Hank Hewelke. The group expects to hold its next meeting in Berkeley at Spencer's Grotto.

• • • •

Center Electric Engineering, Tacoma, Wash., arranged demonstrations and discussion of transmission drives for Puget Sound Chapter's May 5 meeting at Tacoma.

• • • •

A portable dynamic balancer was demonstrated to motor shop operators representatives of the Stewart-Warner Corp. at the Chicago (Central District) Chapter's dinner meeting at Graemere Hotel on June 9.

• • • •

The techniques of training electricians in vocational schools were outlined by James Cowles of Hartford Regional Technical School at a meeting of the Connecticut Chapter at Hamden, Conn. last May.

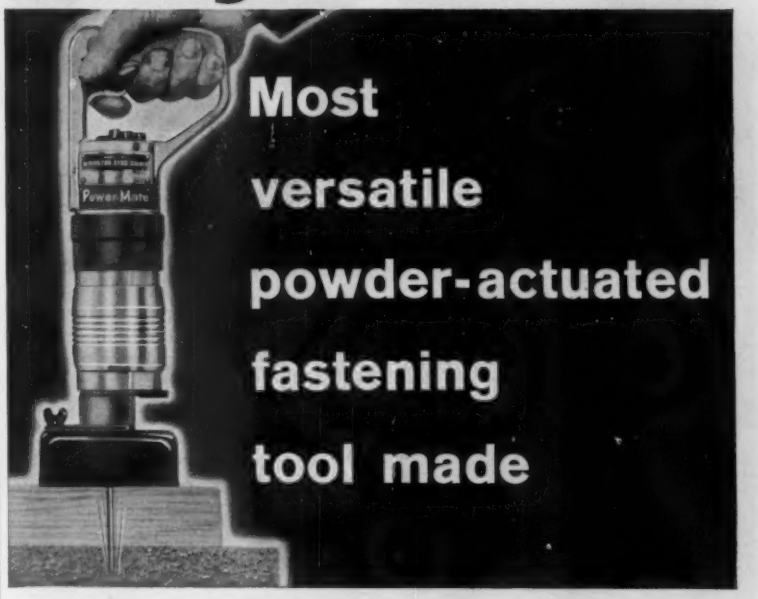
• • • •

The polyester system of insulation was discussed by Robert Wise of Essex Wire Co. at a dinner meeting of Great Lakes Chapter at Insulation & Wires, Inc., Detroit. Hosts at the buffet dinner were Chris Palmer, of Palmer Electric; Jerry Cohen, J-C Electric; and Otto Techow, Otto's Electric, all of Detroit.

• • • •

L. Earl Miller, of Springfield Electric Motor Co., Springfield, Ohio was elected president of Miami Valley (Ohio) Chapter at a meeting at Electric Motor Service, Piqua, Ohio, May 25. B. D. McClain, McClain Electric Co., Greenfield, Ohio was elected secretary; and Edward McLean, Ohio Electric Equipment Co., Dayton, Ohio, treasurer.

Remington Stud Driver



The basic Power Unit...

Here's the single basic tool that gives you a new degree of on-the-job fastening versatility. Only *one* basic unit to buy—the Remington Model 455A—for all your fastening applications. Just choose the instantly interchangeable fastening attachment you need to do the job!

Plus choice of 4 fastening attachments...

K-1 1/4" & 3/8" Light-Duty Captive Stud Attachment uses 22 cal. Power Loads. Use where extra safety is needed.

K-2 1/4" Light-Duty Attachment uses 22 cal. Power Loads. Handles 80% of your fastening jobs.

K-3 3/8" Medium-Duty Attachment drives heavy-duty studs with inexpensive 22 cal. Power Loads.

K-4 3/8" Medium and Heavy-Duty Attachment. Uses both 22 and 32 cal. Power Loads. For toughest jobs.

offers greatest single-tool fastening versatility!

The Remington Stud Driver offers these exclusive features:

- Four fastening attachments for light, medium, heavy-duty work, including the special Captive Stud Attachment for extra-safe fastening. No other single tool can cover such a variety of applications.
- Medium-duty fastening—requiring 3/8" studs—can be done with low-cost 22 caliber Power Loads.
- Positive one or two-hand operation at operator's option . . . no buttons or release to hold while fastening.
- Greater variety of applications made possible with instantly interchangeable guards. These 4" square, hollow "safety guards" fit snugly over work, trap spall and dust. More than 40 types are available.

Send coupon for free booklet about the Remington Stud Driver—your best buy in powder-actuated fastening tools!

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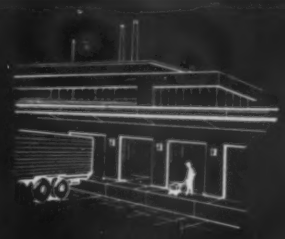

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surface junction boxes for both ceiling and wall mounting when exposed conduit is required.

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MANY CANADIANS attended the recent annual convention of the National Industrial Service Association, at Montreal, Canada, including: (l to r) Marcel Piette, Donat Piette, Joliette, Quebec, and Lloyd Harlock, Harlock-Schultz Electric, Guelph, Ont.

Arthur C. Roe, NISA engineer, and Gordon Hines, of Electronic Dynamic Balancing Co., a distributor of the Stewart-Warner dynamic balancer, spoke at the June 9 meeting of Chicago Chapter at Hotel Graemere.

• • • •

The annual summer meeting of the Florida section of the Southeastern Chapter was held on August 7-9 at Galt Ocean Mile Hotel, Fort Lauderdale, Fla. Horace Barks of Horace Barks Publications, St. Louis, spoke on "How Advertising Affects the Motor Repair Shop."

• • • •

The Great Lakes chapter held its regular meeting at the Detroit branch office of Insulation & Wires on June 15. A buffet lunch was furnished by Palmer Electric Co., J-C Electric Co. and Otto's Electric Co. Approximately 55 attended. Robert Wise, technical sales and service engineer, of Essex Wire Corp., spoke on the polyester system of insulation.

• • • •

A meeting of the Midwestern Chapter was held at the Castle Hotel, Omaha, Neb., on April 4.

• • • •

National Secretary Murphy Miller Sr., Tennessee Electric Motor Service, Knoxville, Tenn., and Executive Vice-President Joseph M. Harrington reported on the Montreal Convention at the Mid-South Chapter meeting at Paris Landing, Tenn., June 12-13. Gary Underwood, of Brook Motor Co., Memphis, Tenn., was host at a Tennessee Country Ham breakfast on Saturday. A boat trip, lunch and dinner concluded the meeting.

• • • •

New York Chapter resumes op-

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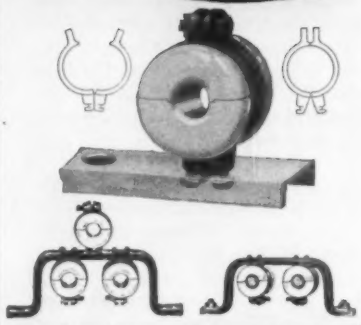

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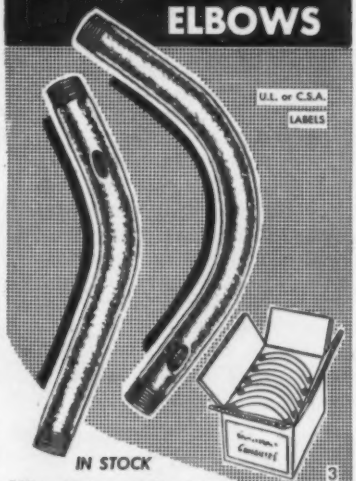

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erations at a joint meeting at Lake Sacandaga in the Adirondacks in New York with the New England, Connecticut and Niagara Chapters September 11-13.

• • • •

Fourteen attended a meeting of North Central Chapter at the Francis Drake Hotel in Minneapolis, June 27. Earl Wheat, Robert Root and Warren Mielke reported on the NISA Montreal Convention.

• • • •

An "A. C. Roe Meeting" will be held in Charlotte, N. C. next April as the NISA staff engineer will be the featured speaker and discussion leader for the entire Friday morning program. Ed Jenkins, Armature Winding Co., Charlotte, and Roy Shinault, Roy's Electric Motor Service, Richmond, Va. will speak on bearing applications and power tool repairs on Saturday morning.

• • • •

F. E. Cahoon, Virginia-Carolina Electrical Works, Norfolk, Va.; O. R. Patrick, Smith-Gray Electric Co., Columbia, Ga.; and Warren E. Dickson, Leesburg Armature Works, Leesburg, Fla., have joined the Southeastern Chapter.

• • • •

Southwestern Chapter is preparing for its fall meeting on September 17-19 at the Shamrock-Hilton, Houston, Texas. NISA president H. C. Blenkhorn will be one of the speakers, Executive Secretary Ann Hickman has announced. Chairman of the program is A. C. Dudley and Dick Bradley. Other chairmen include Frank Foshee, publicity; Emil Shumberg, Harry Gumbert, Carl Schleyer, and A. L. Miller, entertainment; A. C. Dudley, Phil Glynn and Marvin Cole, transportation; and Fred Fahrenkamp, prizes. Theme of the meeting: "The Motor Shop's Expanding Role and Responsibility to Industry."

• • • •

Michael Assalone, Florida Electric Motor Co., Miami, Fla., was named general chairman of the 1960 NISA Convention, to be held at the Hotel Fontainebleau, Miami Beach, on May 4-7. Other chairmen include Mrs. J. Arthur Turner Jr., Tampa, Fla., women's program; Joe M. Wright, Turner Electric Co., Jacksonville, Fla., program; Lewis S. Bain, Jack's Electric Motor Shop, Fort Lauderdale, Fla., entertainment; William King, King's Electric Motor Shop, Miami, transportation; Ralph Swartz, Peninsular Armature Works, Miami, exhibits; and Richard F. Taylor, A & F Electric Motor Repair, Miami, information.

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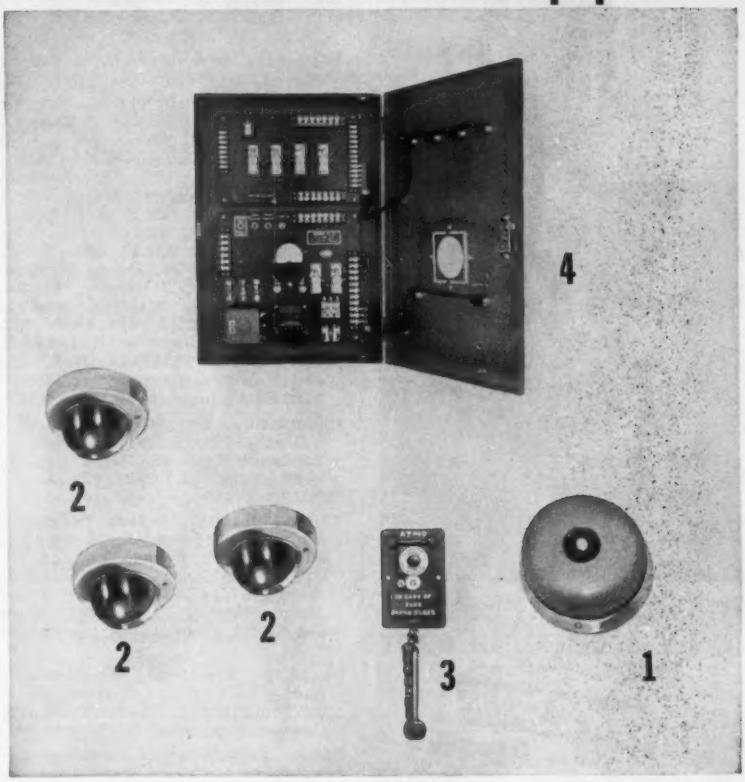

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DATES AHEAD

International Association of Electrical Leagues — El Cortez Hotel, San Diego, Calif., Week of August 10.

Western Electronic Show & Convention—Cow Palace, San Francisco, Calif., August 18-21.

International Association of Electrical Inspectors — Northwestern Section, Hotel New Washington, Seattle, Wash., Aug. 24-26; **Southwestern Section,** Flamingo Hotel, Santa Rosa, Calif., Aug. 31-Sept. 2; **Eastern Section,** Essex and Sussex Hotel, Spring Lake, N. J., Sept. 14-16; **Canadian Section,** Queen Elizabeth Hotel, Montreal, Quebec, Canada, Sept. 25-26; **Western Section,** Schroeder Hotel, Milwaukee, Wis., Oct. 5-7; **Southern Section,** Heidelberg Hotel, Jackson, Miss., Oct. 12-14; **Mississippi Chapter,** Heidelberg Hotel, Jackson, Miss., Oct. 12-14.

Illuminating Engineering Society — National Technical Conference, Fairmont Hotel and Mark Hopkins, San Francisco, Calif., September 7-11.

Third Industrial Nuclear Technology Conference—Co-sponsored by Armour Research Foundation and NUCLEONICS magazine, with the cooperation of the United States Atomic Energy Commission, Morrison Hotel, Chicago, Ill., September 22-24.

Canadian Electrical Manufacturers Assn.—15th annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., Canada, September 30-October 2.

Florida Association of Electrical Contractors—Annual convention and 7th Electrical Trade Show, Robert Meyer Hotel, Jacksonville, Fla., October 7-10.

11th Biennial Electrical Industrial Exposition—Sponsored by Essex Electrical League; Armory, Elizabeth, N. J., October 10-12.

National Electronics Conference — Sherman Hotel, Chicago, Ill., October 12-14.

Electrical Progress Show—Sponsored by Electrical Association of Philadelphia, Convention Hall, Philadelphia, Pa., October 13-15.

National Electrical Contractors Association—Annual convention and 5th National Electrical Exposition, Fontainbleau, Eden Roc, Deauville and Carillon Hotels, Miami Beach, Fla., November 9-12.

National Electrical Manufacturers Assn.—Annual meeting, Traymore Hotel, Atlantic City, N. J., November 9-13.

Industrial Electric Exposition—Sponsored by Electrical League of Western Pennsylvania, Penn-Sheraton Hotel, Pittsburgh, Pa., November 17-19.

American Institute of Electrical Engineers—Winter general meeting, New York, N. Y., January 31-February 5, 1960.

16th Annual National Wiring Sales Conference—Warwick Hotel, Philadelphia, Pa., February 25-26.

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Among the Manufacturers

Headquarters Announcements

Anaconda Wire and Cable Co. has acquired the **Sequoia Wire and Cable Co.**, Redwood City, Calif., which will operate as a subsidiary company.

Transolite Corp., New York, and **Aluminum and Chemical Corp.**, Greenwich, Conn., have signed an agreement to manufacture Transolite's U-shaped fluorescent lighting fixtures.

National Electric Div., H. K. Porter Co., Inc., Pittsburgh, Pa.—Thomas M. Porter, director of purchases.

Electromode, Div. of Commercial Controls Corp., Rochester, N. Y.—**Jae & Meyer Co., Inc.**, sales and engineering representatives for complete line of Electromode equipment and all electric space heating systems.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Robert J. Dineen, manager, product sales, electrical department, Norwood (Ohio) works; William C. Krecklow and George J. Slies, general superintendents, manufacturing department of Industries Group.

Hudson Lamp Co., Kearny, N. J. —Walter E. Carpenter, chief engineer.

Simplex Wire & Cable Co., Cambridge, Mass.—John W. Logan, vice president.

Line Material Industries, Milwaukee, Wis.—Leroy Peppey, planning engineer, distribution apparatus; Robert E. Deal, manager of capacitor sales and service.

Holub Industries, Inc., Sycamore, Ill.—Paul F. Froeb, manager of merchandising.

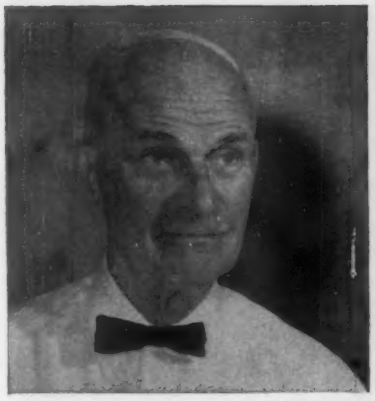
Cutler-Hammer Inc., Milwaukee, Wis.—P. B. Harwood, senior vice president; E. B. Fitzgerald, vice president in charge of engineering; George A. Rauch, manager, merchandising and sales promotion division; R. A. Haworth, apparatus sales manager.

Blackhawk Mfg. Co., Milwaukee, Wis.—Paul F. Moore, sales manager, Industrial Division.

Beaver Pipe Tools, Inc., Warren, Ohio—E. J. Cassella, vice president of manufacturing; Donald W. Lininger, assistant sales manager.

Sylvania Lighting Products, Salem, Mass. — William A. Rotunno, marketing specialist, Panelescent lamps.

Thomas & Betts Co., Elizabeth,



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says Paul Dooley of Dooley Electric Company, New York

"Ever heard of 'bandaging' electrical cables? I never had . . . and I thought I knew my business.

"But now that I've heard about it—and realize what a risk it can be—I've modernized my ideas about cable-installing.

"Well, what is a 'bandage' anyway? It's a covering designed to protect an injury while it heals. It's temporary. However, electrical cables are not temporary. Good ones should last for years, providing continuous power to equipment and machinery.

"We know, however, there are critical areas in electrical cable systems where you can anticipate trouble. These areas are the terminations and splices in the cable. Unless they're as well constructed and designed as the cable itself, the entire system is weakened. It's the old story—'A chain is only as strong as its weakest link.'

"That's why splices and terminations should match the cable . . . and perform just as reliably.

"For example . . ."

"When you make a splice or termination you've got to remove part of the cable's insulation and sheath to make connections. Now, the insulation and sheath must be replaced. I hadn't thought of it before, but there lies the secret.

"At this point you could either 'bandage' the cable with ordinary covering materials (as I used to do) or do it the right way. That is to:

1. **Make sure you replace the cable insulation with a tape made of true cable insulating compound.**
2. **Make sure you replace the cable sheath with a tape made of true cable sheathing compound.**

"If you take this little extra care, your splices—like mine—will be 'duplicates' of the cable itself, not 'weak links' in it.

"The engineer who told me about the risks of 'bandaging' was a man with 15 years' experience in cable engineering. His company – Okonite – has designed and manufactured superior electrical cables for more than 80 years. They know their business.

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Cutler-Hammer Inc.: T. R. Christian, Atlanta district manager.

Pyle-National Co.: Curtis H. Stout, Inc., representative in South-Central area.

EAST CENTRAL

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Pyle-National Co.: H. R. Weibel, Glen Ellyn, Ill., Central Region manager.

Stanley Electric Tools: Richard W. Cooper, sales representative in Cleveland territory.

Daystrom-Weston Sales Div., Daystrom, Inc.: Carl G. Ketel, manager, new Cedar Rapids branch office serving eastern Iowa, Moline and Rock Island, Ill.

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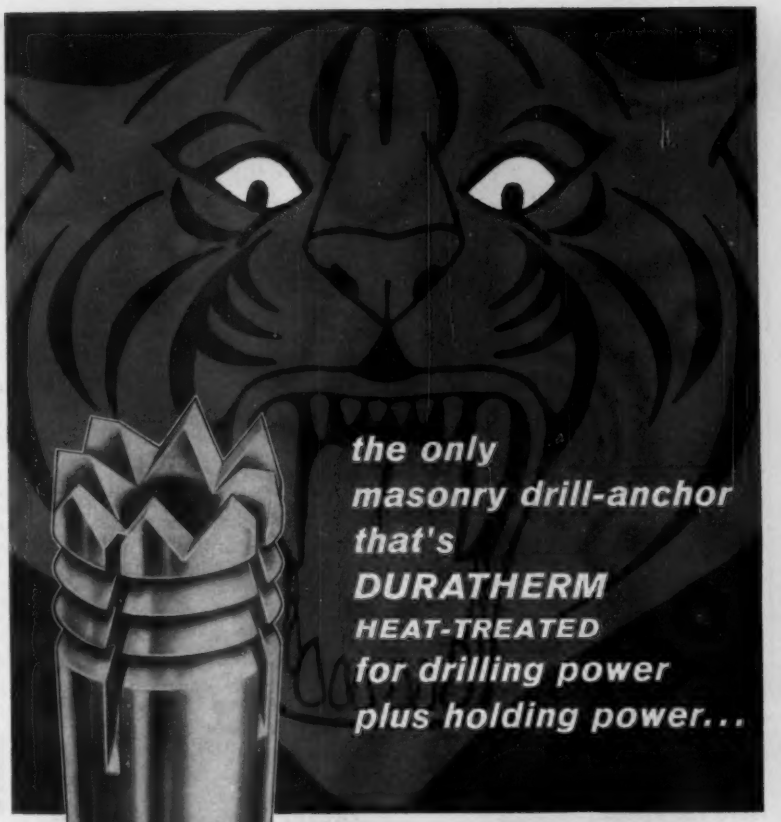

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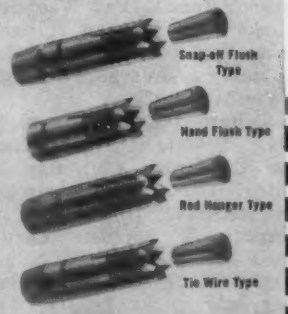

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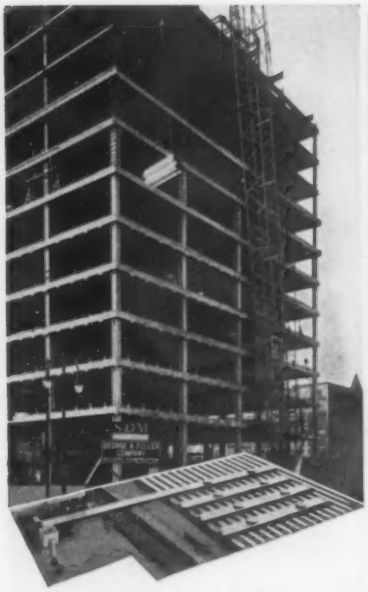

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Electro Lighting Corp.: Richard Clifcorn, district manager in Wisconsin and upper Michigan.

John C. Virden Co.: Marion L. Dick, sales representative in state of Wisconsin.

Okonite Company: Douglas J. O'Connor, branch manager of new Tulsa, Oklahoma office.

WEST

Quadrangle Mfg. Co.: Al Thompson, representative in Wyoming and Colorado; Floyd Wilson Co., representative in Oklahoma.

Federal Pacific Electric Co.: Robert L. Lemman, manager of North Pacific sales region.

Okonite Company: Sam R. Howard, district manager, Los Angeles district office; James F. Angle, district manager, Salt Lake City district office.

Western Lighting Corp.: New representatives: Dan Radke, San Francisco; Tom R. Van Wagoner, Salt Lake City; Norman F. Ross, Phoenix; Earl Stearns, Sales, Tacoma; Harry L. Stearns, Portland; Ross Vieths, Seattle.

C & D Batteries, Inc.: Joseph C. Platt Co., Seattle representatives.

John C. Virden Co.: Ray E. Wendling, sales agent for Arizona, office in Phoenix.

International Rectifier Corp.: Pacific Electro-Sales, Inc., industrial sales representative in San Diego area.

McGraw-Edison Measurements Div.: F. Y. Gates Co., representatives for Rocky Mountain area.

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MINERALLAC ELECTRIC COMPANY
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Equipment, Materials, Supplies and Services for Electrical Construction—Maintenance—Repairs

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This WHERE-TO-BUY section is a special classification for advertisers desiring advertising of new equipment, services or merchandise in space units smaller than the minimum run of book display space. Space is available in this section in units from one to 4 inches. For low rates, Write:
ELECTRICAL CONSTRUCTION & MAINTENANCE
POST OFFICE BOX 12
NEW YORK 36, NEW YORK

ADEQUATE JOB RECORDS

[FROM PAGE 95]

When the aforementioned procedures are completed, we turn our attention again to the job card. To it, we staple the original customer order, possibly a permit sheet, any memos we may want to refer to later and a carbon copy of the invoice. We then file the card in the accounts receivable section of the 6- by 9-in. card file.

As we receive payments, they are credited into our "Red Book" section 1 and 3, our daily cash section and the customer ledger, as well as being marked paid on the proper job card.

Naturally, quite a few of the calls we receive are for "check outs" or to give estimates. If we have not been authorized to go ahead on these inquiries within 30 days, we cancel the order, enter the cancellation in section 1 of the Red Book, mark the job card cancelled and file the card in the paid file.

At certain times during the year when job orders are slow coming in, we begin to fear that there might be something wrong with our business. It is most reassuring to us when I quickly check our records and come up with the information that these particular weeks are consistently less busy each year, but that they are always followed by rush periods. We have charts showing a ten-year average (by month) on the following:

Job orders received per month.

Sales put on the books during each month.

Total amount of materials used per month (dollarwise).

Dollar amount of payroll used per month.

Number of employees per month.

We like to compete against these figures. Each year we try to better our sales and reduce costs even though regular advances in wages are given.

My remarks and descriptions of our procedure for keeping job records are not meant to give the impression that we have a perfect system. There is always room for improvement. We work continually to find improvement in methods used, and time consumed for all our jobs. The procedures I have outlined to you could be greatly reduced and you would still get some good from them.

SEARCHLIGHT SECTION

(Classified Advertising)

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DISPLAYED —RATES—	UNDISPLAYED
Employment Opportunities—$24.00 per inch, subject to Agency Commission.	$1.80 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.
Equipment & Business Opportunities—$17.00 per inch, not subject to Agency Commission.	*Position Wanted* ads take one-half of above rate.
An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.	*Box Numbers* in care of our New York, Chicago & San Francisco offices count as one additional line.
Equipment Wanted or For Sale Advertisements acceptable only in Displayed Style.	*Discount of 10%* if full payment is made in advance for 4 consecutive insertions.

Send New Ads to Classified Advertising Div. Electrical Construction & Maint. P.O. Box 12, New York 36, N.Y.

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BOUGHT — SOLD — RENTED
REWOUND — RE-DESIGNED
MANUFACTURED

Ask For Our Price Schedule And Stock List

THE ELECTRIC SERVICE CO., 5322 Hetzel St., Cincinnati 27, Ohio

"America's Exclusive Independent Transformer Service Shop"

An Investment!

Productive advertising is an INVESTMENT rather than an EXPENDITURE.

"Searchlight" advertisers almost invariably report prompt and satisfactory results.

BE CONVINCED — send us your advertisement TODAY.

Address
Classified Advertising Division

Electrical Construction & Maintenance

P. O. BOX 12, N. Y. 36, N. Y.

ADDRESS BOX NO. REPLIES TO: Box. No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

BUSINESS OPPORTUNITY

Electrical Estimator wanted for fast growing contracting firm in Southern California. BO-1533, Electrical Construction & Maintenance, San Francisco.

ELECTRICAL ENGINEERS

With 3 or more years experience in electrical design for buildings including lighting, distribution, wiring, etc. Permanent employment with well-established midwestern consulting engineering firm. Write giving personal resume and required salary. P-2036, Elec. C&M
520 N. Michigan Ave., Chicago 11, Ill.

Your inquiry will have Special value . . .

If you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, it will identify you as one of the men the advertisers wants to reach with this message . . . and help to make possible enlarged future service to you as a reader.

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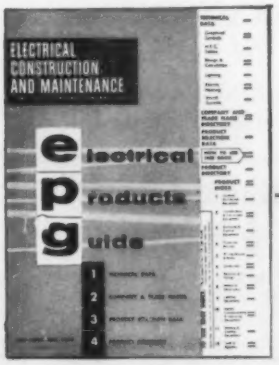
CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES ... 205

BUSINESS OPPORTUNITIES
Wanted 205

EQUIPMENT
(Used or Surplus New)
For Sale 205



• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE

For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

THIS COMPLETE LINE MEETS EVERY NEED FOR PUSHBUTTONS

STANDARD DUTY

HEAVY DUTY

Name your pushbutton requirement—there's a Square D unit to do the job, exactly. Three complete lines . . . standard duty, heavy duty, and oil-tight heavy duty . . . each providing a wide range of operators, stations, and circuit combinations.

Write for Pushbutton Bulletins which give complete details. Address Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.

OIL-TIGHT HEAVY DUTY

Available in 1 to 16 unit sizes. 6-9-12-16 unit stations have hinged covers for easier wiring

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

CROUSE/HINDS

Condulet®

electrical equipment

the one complete line for corrosive locations

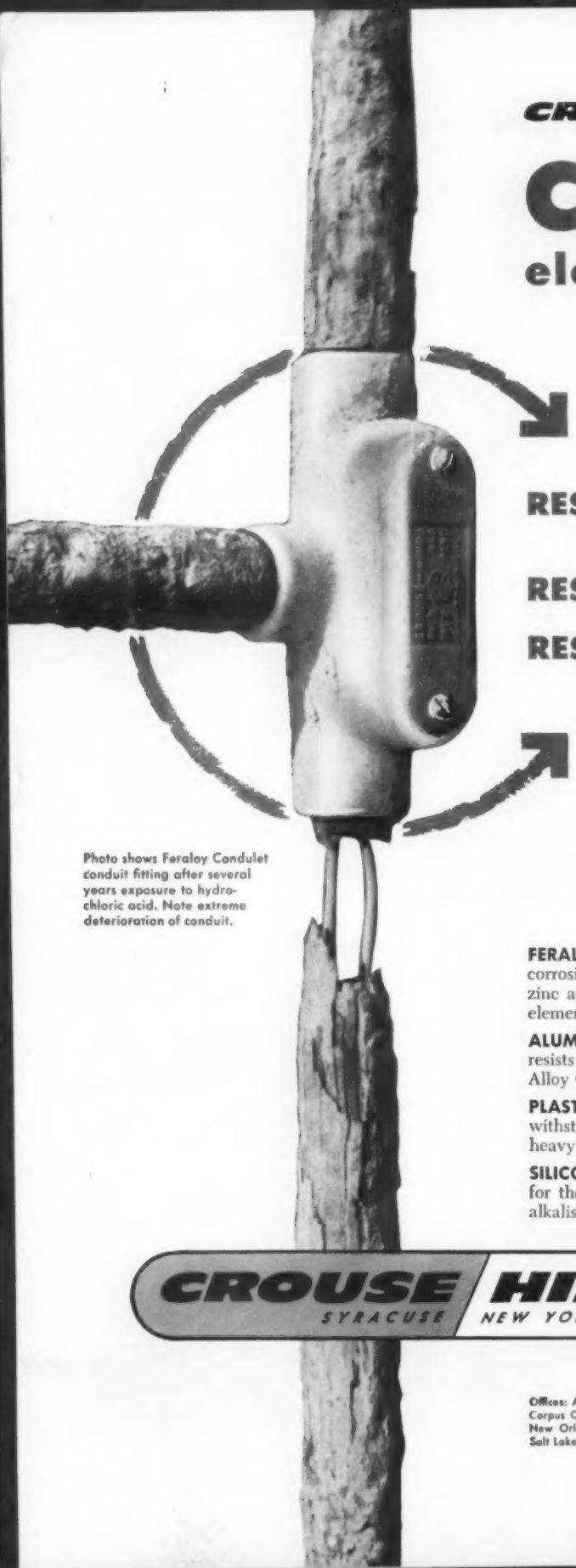


Photo shows Feraloy Condulet conduit fitting after several years exposure to hydrochloric acid. Note extreme deterioration of conduit.

RESISTS chemical and galvanic corrosion

RESISTS acids, alkalis, salts

RESISTS varying concentrations and temperatures of corrosive liquids, vapors, gases, dusts

Corrosion problems would be simple if there were a single material which would resist all corrosive substances.

Since there is not, Crouse-Hinds provides electrical equipment in four materials which offer a selection to meet virtually every known corrosion problem . . .

FERALOY® features the desirable characteristics of cast iron: strength, corrosion resistance, versatility, adaptability, economy. Plated with zinc and cadmium, Feraloy Condulets will combat most corrosive elements.

ALUMINUM ALLOY develops its own self-repairing oxide film which resists a number of corrosive conditions. Copper-free Aluminum Alloy Condulets effectively resist galvanic corrosion.

PLAST-A-COAT, a polyvinyl chloride, is a resilient coating which withstands abrasion and repels corrosion from caustics, alkalis and heavy mineral acids. Tough, non-peeling, it also acts as an insulator.

SILICON BRONZE, when all other materials fail, can be furnished for the most extreme corrosion problems. Counteracts virtually all alkalis as well as salt water, sulfur gases, etc.

CROUSE HINDS
SYRACUSE NEW YORK

Write for **BULLETIN #2699** containing full information on Crouse/Hinds Condulets for Corrosive Locations.

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Crouse-Hinds Instrument Company, Inc., Silver Spring, Md.